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ABSTRACT

The analysis of data from the baseline cycle of the National Science Foundation instrumentation survey has two principal objectives, namely, to construct and examine a variety of quantitative statistical indicators describing major characteristics of the current national stock of academic research equipment and to document differences among research fields in these indicators. Findings are reported and discussed for seven areas: (1) department heads' assessments of instrumentation needs and priorities; (2) aggregate amounts and costs of research equipment in the 1982-1983 national stock; (3) annual instrumentation-related expenditures; (4) instrumentation age and condition; (5) funding patterns; (6) instrumentation location and usage; and (7) instrumentation maintenance and repair. A final section contains a brief summary of these findings. The document also includes six appendices. They provide technical notes (including survey design and response rates), detailed statistical tables, and information on project advisors, data forms, and statistical precision of survey instruments. For most indicator statistics (in the second appendix) a series of three tables are presented. The first gives overall findings across all science and engineering fields. The second and third provide breakdowns for subfields of engineering and physical sciences and for subfields of agricultural and biological sciences. (JN)

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ACADEMIC RESEARCH EQUIPMENT IN SELECTED SCIENCE/ENGINEERING FIELDS, 1982-83

An Analysis of Findings from
the Baseline National Survey of Academic Research
Instruments and Instrumentation Needs

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TABLE OF CONTENTS

	Page
ACKNOWLEDGEMENTS	iv
GENERAL NOTES	vi
EXECUTIVE SUMMARY	viii
INTRODUCTION	1
BACKGROUND	1
THE BASELINE SURVEY	2
THIS REPORT	4
RESULTS	5
1. NEEDS AND PRIORITIES	5
2. THE NATIONAL STOCK	11
3. ANNUAL EXPENDITURES	19
4. RESEARCH STATUS, AGE, AND CONDITION	23
5. FUNDING SOURCES	33
6. LOCATION AND USAGE	39
7. MAINTENANCE AND REPAIR	47
APPENDICES	55
APPENDIX A: Technical Notes	A-1
APPENDIX B: Detailed Statistical Tables	B-1
APPENDIX C: Project Advisory Groups	C-1
APPENDIX D: Interagency Working Group on University Research Instrumentation	D-1
APPENDIX E: Department/Facility Questionnaire	E-1
APPENDIX F: Instrument Data Sheet	F-1
APPENDIX G: Sampling Errors	G-1

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Contractor staff who played significant roles in the survey and in the preparation of this report were:

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In addition to the NSF and Westat project staff, two advisory groups contributed significantly to the project. The first, the Interagency Working Group on University Research Equipment convened by NSF, played important roles in reviewing project feasibility study results and in providing NSF with recommendations about key features of the research design. Secondly, the project's Advisory Groups made many valuable contributions both in the refinement of the research design and in the assessment of findings. The members of these two groups are listed in Appendices C and D.

GENERAL NOTES

This report presents information from the two-phase baseline cycle of the National Science Foundation's (NSF's) National Survey of Academic Research Instruments and Instrumentation Needs. Phase I, conducted in early 1983 with reference to instrumentation existing on December 31, 1982, involved collection of instrument-related data from physical and computer science and engineering departments at a stratified probability sample of 43 universities. The following year, in Phase II, data pertaining to 1983 instrumentation were collected for the agricultural, biological and environmental sciences at the same 43 universities. Phase II also included biological science departments (not clinical departments) at a stratified probability sample of 24 medical schools. Medical school data collection was funded by the National Institutes of Health.

In each phase, (a) department and facility administrators were surveyed to ascertain their equipment-related activities, needs and priorities, and (b) samples of existing research equipment were selected and the responsible faculty investigators were asked to provide information about each item's age, condition, cost, usage, etc. The equipment survey was limited to research instrument systems with an orignial purchase price of $10,000 to $1,000,000. The resulting data bases contain questionnaire responses from over 900 department and facility heads and for over 10,000 individual items of research equipment.

A preliminary analysis of findings for Phase I fields was published in 1984.[1] The present report expands the analysis to include updated results for both phases. The data base includes a number of questionnaires for Phase I departments and instruments that arrived too late for representation in the preliminary analysis. Consequently, findings for Phase I fields are now slightly different (i.e., more accurate) than those contained in earlier analysis.

[1]National Science Foundation, Academic Research Equipment in the Physical and Computer Sciences and Engineering, 1984.

Throughout this report, the notation "1982-83" is used to indicate that findings for Phase I fields are for instrumentation status as of December 31, 1982 while findings for Phase II fields describe status as of December 31, 1983.

Unless otherwise specified, findings for biological science fields include data from both medical schools and graduate schools.

EXECUTIVE SUMMARY

The National Science Foundation's National Survey of Academic Research Instruments and Instrumentation Needs received strong support among respondents. Although substantial time and effort were required to provide the many survey lists, forms and questionnaires, each of the 43 universities and 24 medical schools in the original study sample participated fully in the research, and all questionnaire response rates were well above 90 percent. In and of itself, this extraordinary level of response is a significant indicator of the extent of concern that exists throughout the academic community about the adequacy of the current stock of research equipment.

This concern, implicit in the study's high response rates, was expressed explicitly in the survey of heads of research departments and facilities:

- Seventy-two (72) percent of the department heads in the fields surveyed reported that, as a result of lack of needed equipment, there are presently important subject areas in which their research personnel cannot conduct critical experiments.

- Overall, 43 percent of the department heads in these fields characterized the research instrumentation presently available to untenured faculty as typically "insufficient;" almost as many (36%) so characterized the equipment available to tenured researchers.

- According to 87 percent of the department heads surveyed, the top priority need was for upgrading and expansion of research equipment in the $10,000 to $1,000,000 range — the range encompassed by the survey of existing equipment.

AMOUNT AND CONDITION OF EXISTING EQUIPMENT

- The quantitative findings appear generally consistent with department heads' qualitative assessments of current instrumentation inadequacies. For example, the estimated original purchase price of the entire national stock of all $10,000 to $1,000,000 academic research equipment in the fields surveyed is $1.6 billion, only one-third the total amount being spent for research and development in these fields

in a single year.[1] In functional terms, the current (1982-83) national stock is even smaller, since one in every five research instrument systems physically present at the time of the survey had been completely inactive for at least a full year and was technologically and/or mechanically obsolete.

- At the other end of the spectrum, only 17 percent of existing systems in the fields surveyed were classified as state-of-the-art.

- Nearly one-half of all research instrument systems was purchased within the previous 5 years; one-fourth was 6 to 10 years old; and the remaining three-tenths was 10 or more years old.

- For the bulk of the equipment in research use, that which was not state-of-the-art, over half (57%) was in less than excellent working condition, and almost half (46%) was the most advanced equipment to which the research users had access, indicating that academic investigators frequently do not have access to advanced equipment even when needed.

FUNDING

- Three-fifths of all in-use research equipment (62%) was acquired partly or entirely with Federal funding support.

- NSF was the principal source of Federal instrumentation support, accounting for 20 percent of the aggregate acquisition cost of all in-use research equipment in the fields surveyed. NIH (National Institutes of Health) was also a major source of instrumentation funding, accounting for an overall 15 percent of all instrumentation support and for a substantial 39 percent of instrumentation support in the biological sciences.

- Recently-enacted Federal tax incentives aimed at increasing industrial donations of research equipment to colleges and universities appeared not yet to have had much of an impact. Only two percent of in-use academic research equipment in the fields surveyed had been donated from any source, industrial or other. Most in-use equipment (89%) had been purchased new, off the shelf. The rest (9%) were acquired through various other means, e.g., locally built, purchased used, government surplus.

[1] For Fiscal Year 1982, total reported research and development expenditures in fields represented in the present study were $4.7 billion. See National Science Foundation, Academic Science/Engineering: R&D Funds, Fiscal Year 1982 (Detailed Statistical Tables), (NSF 84-308), 1984, p. 138.

UTILIZATION

Since the supply of equipment needed for frontier research is limited, it is important that the equipment which does exist be well utilized. Insofar as one can judge from the mass of survey statistics pertaining to location and usage, it appears that conscientious efforts are being made to achieve widespread, equitable sharing of available research equipment:

- Two-fifths (41%) of all in-use academic research equipment was located in inherently shared-access facilities — department-managed common labs, national and regional labs, etc.
- Although a substantial fraction (27%) of in-use equipment was not amenable to widespread usage (being dedicated for use in a particular experiment) and although much of this dedicated equipment was located in within-department labs of individual investigators, the mean annual number of research users of instruments located in such labs was 8.9, a figure hardly suggestive of restricted access.
- The mean annual number of users of research instrument systems that were located in inherently shared-access facilities was 21.8 users per system.
- Particularly for comparatively high cost instruments, there was considerable evidence of routine sharing of equipment beyond the confines of the host department or facility — sharing with faculty and students from other departments and even with those from other universities or from non-academic settings.

MAINTENANCE AND REPAIR

- On the average, departments spent $35,000 per year, or 16 percent of their annual instrumentation-related expenditures, for maintenance and repair (M&R) of existing research equipment.
- Most research departments in the fields surveyed (87%) operated or had access to on-campus machine shops or other facilities for M&R of their research equipment. However, only 11 percent of the departments in these fields assessed their M&R facilities as excellent.
- Service contracts constituted by far the most common form of maintenance and repair of research equipment in computer science and in the biological sciences: 38 to 53 percent of all in-use systems in these fields were maintained principally through service contracts.

By contrast, on-campus M&R and research personnel were the principal sources of M&R for equipment in the physical and environmental sciences and engineering, where 47 to 51 percent of all in-use research systems were maintained and repaired principally by in-house staff.

DIFFERENCES AMONG FIELDS

Engineering and the physical and environmental sciences differed from the biological sciences in several respects:

- Existing instrumentation in the biological sciences consisted largely of general purpose, off-the-shelf instruments of comparatively low unit cost located in labs of individual investigators. This was less often the case for the other fields, which had more complex, custom designed, high-cost systems and more systems in shared-access facilities.

- Differences in equipment needs followed the same pattern, with all fields generally needing more of the same kinds of equipment they presently have.

- In the biological sciences, equipment maintenance and repair (M&R) did not seem to be a major problem; it was handled largely by sources outside the university (or medical school) — through service contracts or field service. For the other fields, in-house M&R facilities were the principal resource for equipment servicing, and these facilities were less than satisfactory in many instances.

- Particularly for medical schools, Federal instrumentation support in the biological sciences came predominantly from NIH, which focused almost entirely on these disciplines. For the other research fields, Federal instrumentation support came from a mix of agencies, of which NSF and the Department of Defense were the major contributors.

- Eighty-five (85) percent of the heads of medical school biological science departments assessed the research equipment available to their senior, tenured investigators as generally "excellent" or "adequate." In most other fields, however — including biological science departments in university graduate schools — upwards of 40 to 50 percent of department heads evaluated the equipment available even to tenured investigators as generally "insufficient."

Two fields with comparatively small national stocks of research equipment, computer science and the agricultural sciences, were polar opposites in many respects:

- The median purchase price of existing instrument systems was highest in computer science ($54,000 per system) and lowest in the agricultural sciences ($22,000 per system).

- Research equipment in the agricultural sciences was concentrated almost entirely in public universities; by contrast, computer science research equipment was located predominantly in private universities.

- Of the fields studied, computer science was the most equipment-intensive, in that it had the highest mean annual expenditures for research equipment per faculty-level investigator ($12,700 per investigator per year); the agricultural sciences were the lowest of all fields on this indicator ($4,300 per investigator per year).

- The agricultural sciences had the highest proportion of their instrumentation funding support from state and university sources (67%); computer science was least dependent upon these sources, having received its instrumentation support primarily from a mixture of Federal (46%) and business (16%) sources.

- The mean number of research users per system per year was lowest in the agricultural sciences (11.0) and was highest for computer science (59.2).

Although different from one another in many ways, the agricultural, biological and computer sciences were alike in that — as compared to equipment in the physical and environmental sciences and engineering — their research equipment consisted largely of off-the-shelf instruments that had been purchased new and that continue to be maintained and repaired by the manufacturer (through service contracts or field service) rather than by in-house facilities and personnel.

INTRODUCTION

BACKGROUND

Recent advances in microcircuitry and other fields have led to the development of new generations of research instruments with capabilities vastly more powerful than those available 10 or 15 years ago. As measurement tools have become increasingly complex and powerful, however, they have also become increasingly expensive. During the past decade, as instrumentation costs progressively increased, many of the nation's colleges and universities experienced severe fiscal problems reducing their ability to fund new acquisitions.

The cumulative effects of these trends on academic research are difficult to assess. A 1980 survey of investigators at 16 leading research universities reported numerous instances where scientists felt that, because of a lack of needed instrumentation, they were no longer able -- or were on the verge of being no longer able -- to work at the frontier of research in their respective fields.[1] However, the evidence to date has been largely anecdotal.

In recognition of the need for "objective information in the area," the House Committee on Science and Technology recommended that the National Science Foundation "conduct inventories of, and analyses of the needs for, scientific instrumentation."[2] The resulting legislation, when enacted and signed into law, directed the Foundation to "develop indices, correlates or other suitable measures or indicators of the status of scientific instrumentation in the United States and of the current and projected need for scientific and technological instrumentation."[3] In

[1] Association of American Universities. The Scientific Instrumentation Needs of Research Universities, Report to NSF, 1980.

[2] House of Representative Report No. 96-61 (1979), p. 30.

[3] An Act to Authorize Appropriations for Activities for the National Science Foundation for Fiscal Year 1980, and for Other Purposes. Public Law 96-44, Section 7.

response to this mandate, the Foundation initiated a feasibility study in FY 1980 to: (a) design quantitative indicators of current status and trends in the stock, condition, utilization and needs for research instrumentation in academic settings, and (b) determine the most appropriate data sources and methods of data collection.

The feasibility study, conducted by Westat, Inc. in Fall 1981, concluded that it was feasible to obtain reliable statistical information about current status and trends in academic research instrumentation and presented recommendations concerning data collection methodologies and statistical indicators.[4] Final specifications for the baseline national survey were developed by NSF following extensive review of the feasibility study findings by other Federal agencies, university scientists, and research administrators.

THE BASELINE SURVEY

The NSF baseline instrumentation survey, as it has come to be known, is intended to produce reliable quantitative indicators of the current national stock, cost/investment, condition, obsolescence, utilization and need for major research instruments in academic settings.

The baseline survey was conducted in two stages, or phases. Phase I, conducted during the 1982-83 academic year at a stratified probability sample of 43 universities (excluding Federally-funded R&D Centers), concerned existing academic research instruments and instrumentation needs in the physical and computer sciences and engineering. Phase II, conducted during the 1983-84 academic year, completed the cycle by collecting data for the agricultural, biological, and environmental sciences. The same universities that participated in Phase I were asked to contribute to Phase II as well, together with a separately drawn sample of 24 medical schools, needed to provide a comprehensive picture of academic instrumentation in the biological sciences.[5]

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[4] Indicators of Scientific Research Instrumentation in Academic Institutions: A Feasibility Study. Westat, Inc., March 1982.

[5] Funding support for the medical school component of the Phase II data collection was provided by the National Institutes of Health.

In each phase, two kinds of data were collected. First, all departments and nondepartmental research facilities in applicable fields were asked to provide information about the department or facility as a whole, particularly regarding research equipment costs and needs. Second, from equipment listings supplied by the university (sometimes with assistance from the involved departments), a sample of research instrument systems was selected from each department and facility, and the principal investigator (or other knowledgeable individual) was asked to provide information about the instrument's cost, age, condition, usage, etc. These latter data were used to construct quantitative statistical indicators of the cost, condition, etc. of the national stock of existing academic research instruments in the fields surveyed. Until very recently, it would not have been feasible to obtain the kinds of equipment lists required for the selection of such instrument samples. Most of the computerized university property inventory systems that were so useful in generating sampling lists for the study came into being or were substantially upgraded within the past five years.

The equipment survey was restricted to instrument systems with an original purchase cost of $10,000 to $1,000,000. Systems above this range are generally well-known throughout the research community and are individually subject to ongoing policy assessment. The selection of the $10,000 lower limit was based partly on the feasibility study findings that, while only 10 to 15 percent of the instruments over $500 in labs of individual principal investigators cost $10,000 or more, such instruments accounted for over 80 percent of the aggregate cost of all $500+ instruments. Also, it was the consensus of the NSF Interagency Working Group advisors that individual pieces of equipment below $10,000 are seldom of critical importance in determining whether an academic scientist or engineer is able to pursue his or her research interests.

The response to the baseline survey was truly extraordinary. All 55 sampled institutions agreed to participate in the survey. All 971 applicable departments and research facilities at sampled institutions provided at least partial data to the study, and 912 (94%) submitted complete department/facility questionnaires. Of an initial sample of 10,471 individual items of equipment in these departments and facilities, the requested information was obtained for 10,139 (97%). This remarkable response suggests that the subject of the survey, the adequacy of the research equipment in the nation's universities and medical schools, is a matter of near-universal interest and concern throughout the academic community.

THIS REPORT

This analysis of data from the baseline cycle of the NSF instrumentation survey has two principal objectives: (a) to construct and examine a variety of quantitative statistical indicators describing major characteristics of the current national stock of academic research equipment and (b) to document differences among research fields in these indicators. In the following sections, findings are highlighted with respect to seven topics:

1. Department heads' assessments of instrumentation needs and priorities;
2. Aggregate amounts and costs of research equipment in the 1982-1983 national stock;
3. Annual instrumentation-related expenditures;
4. Instrumentation age and condition;
5. Funding patterns;
6. Instrumentation location and usage; and
7. Instrumentation maintenance and repair.

The final section contains a brief summary of the baseline study findings. Further information about the survey design, response rates, and analysis procedures -- including definitions of key analysis variables -- is presented in Appendix A (Technical Notes). The detailed statistical tables, which provide the basis for the following discussion, are contained in Appendix B. For most indicator statistics, a series of three Appendix Tables is presented. The first gives overall findings across all fields of science and engineering encompassed in the baseline survey, as well as findings for each of the major fields studied. The second and third tables in the series provide additional breakdowns: (a) for subfields of engineering and physical sciences, and (b) for subfields of the agricultural and biological sciences. Project advisors and data forms are identified in Appendices C-F, and Appendix G presents information about the statistical precision of survey estimates.

RESULTS

1. NEEDS AND PRIORITIES

HIGHLIGHTS

- In the fields surveyed, an overall 72 percent of department and facility heads reported important research subjects for which their investigators were unable to perform critical experiments in their areas of interest because they lacked needed equipment. Substantial differences were found among fields, with 87-93 percent of administrators in the physical and computer sciences and engineering but only 56 percent of department heads in biological science fields reporting this problem.

- Overall, 43 percent of department and facility heads characterized the research instrumentation available to untenured faculty as "insufficient." Only 10 percent characterized extant equipment as "excellent." Assessments of the equipment available to tenured investigators were only slightly less pessimistic.

- Concerning instrumentation needs and priorities, the most common recommendation (61% of department/facility heads) was for Federally-assisted upgrading and expansion of equipment in the $10,000 to $50,000 range.

- Another common recommendation was for increased Federal investment in major shared-access instrument systems in the $50,000 to $1,000,000 range (26% of department/facility heads).

- Few department heads identified, as their top priority need, large-scale regional and national facilities (3%) or general enhancement of equipment and supplies in the labs of individual principal investigators (10%).

DISCUSSION

Heads of research departments and facilities at institutions in the study's national sample were asked their views about the adequacy of existing research equipment and about their equipment needs. Their responses were essentially

opinions, and as such, were similar in nature to the many earlier anecdotal reports that have appeared on this general topic. The difference is that the resulting data reliably represent the views of a broad, statistically representative cross-section of academic research administrators, not just the opinions of selected spokespersons or instrumentation advocates.

Capability to Conduct Frontier Research

The first of three need-related questions asked whether there were "any important subject areas in which investigators in this department/facility were unable to perform critical experiments in their areas of research interest because of a lack of needed equipment." On this issue, there was very little difference of opinion among the physical, computer and materials science and engineering departments surveyed in Phase I of this study (see Figure 1). Overall, 89 percent of department and research facility heads in these fields replied in the affirmative, and that was the response (plus or minus 5%) for most individual fields and subfields in Phase I (see Appendix Tables 1 and 1A).

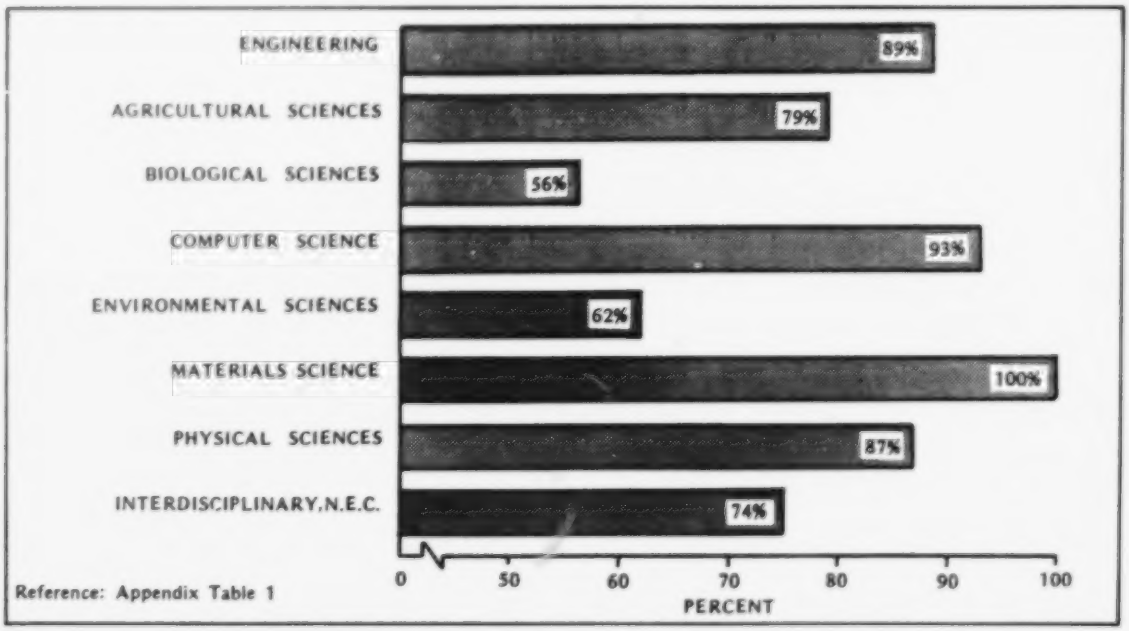

Figure 1. Percent of departments/facilities reporting inability to conduct critical experiments due to lack of equipment, by field

Opinion was more varied among Phase II fields. Heads of agricultural and environmental science departments reported equipment-related inability to conduct important research less often than those in physical sciences and engineering departments. Overall, heads of biological science departments least often reported such handicaps (56%), although there was considerable variation among subfields in this area with reported equipment-related handicaps ranging from 85 percent of heads of food and nutrition departments to only 27 percent of heads of research departments in molecular/cellular biology and genetics (see Appendix Table 1B).

Adequacy of Existing Research Equipment

The second opinion question inquired: "In terms of its capability to enable investigators to pursue their major research interests, is the research equipment in this department generally excellent, adequate or insufficient?" Department/facility heads were asked to respond separately for equipment available to tenured faculty (and equivalent principal investigators) and for that available to untenured faculty (and equivalent principal investigators). Overall, somewhat less than half of the department/facility heads characterized the research equipment available to untenured investigators as insufficient (43%); only 10 percent described it as excellent (see Figure 2). Assessments of the adequacy/sufficiency of the research equipment available to tenured investigators followed the same patterns as those for untenured staff, with "insufficient" ratings being only somewhat less frequent with respect to tenured than untenured staff.

Again, dissatisfaction was more evident in the Phase I than in the Phase II fields. In Phase I fields and subfields, 45 percent or more of the department/facility heads characterized the research equipment available to untenured investigators as generally insufficient (see Appendix Tables 2 and 2A), while several Phase II fields and subfields had much lower levels of expressed concern (see Appendix Table 2B): molecular/cellular biology and genetics (11%); biochemistry (17%), physiology/biophysics (18%), anatomy and pharmacology/toxicology (both 22%), pathology (25%), and general biology (28%). Within the biological sciences, there was a substantial difference in perceived insufficiency of existing research equipment between departments located in medical schools (where only 22%) assessed existing equipment as

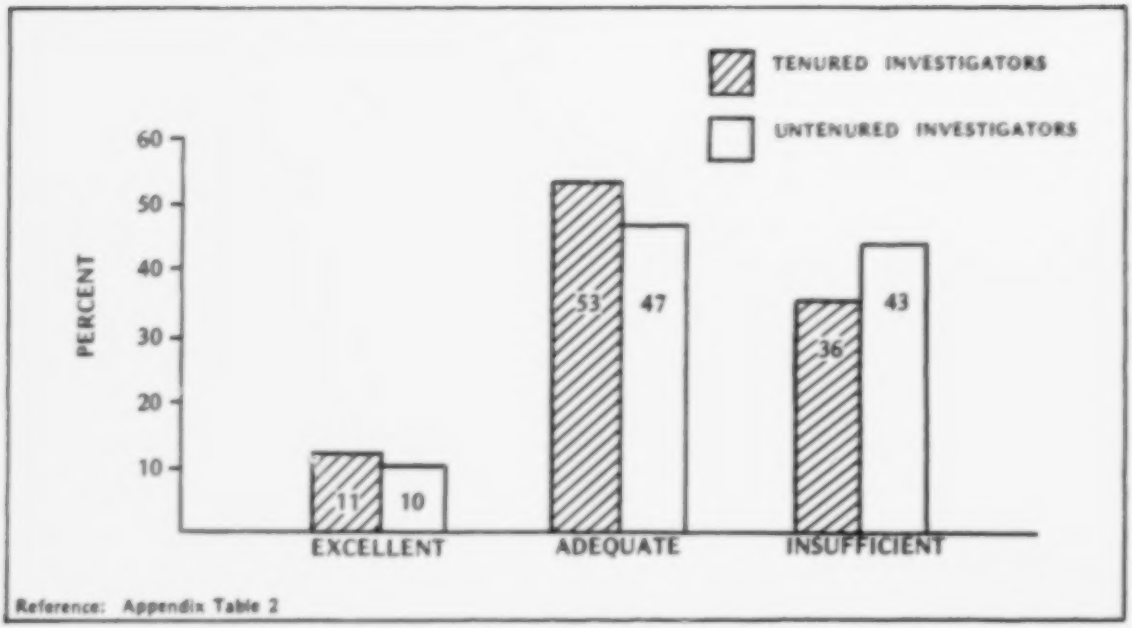

Figure 2. Departmental assessments of the adequacy of the research equipment presently available to tenured and untenured faculty investigators

insufficient) and those located in other academic settings (where 43% assessed existing equipment as insufficient).

Equipment Needs

The third opinion issue concerned department heads' recommendations as to the instrumentation area in which increased Federal investment would be "most beneficial to investigators in this department/facility." One choice, "large scale regional and national facilities (large telescopes, reactors, oceanographic vessels, high performance computers, etc.)," was the top priority recommendation of a few department heads in electrical engineering (10%) and in physics/astronomy (9%). This choice was not generally popular, however. Overall, only two percent of department and facility heads gave this recommendation (see Appendix Table 3).

At the other extreme, "general enhancement of equipment and supplies in labs of individual principal investigators (items generally below $10,000)," was also uncommon. It was selected as the top priority recommendation by only 10 percent of department heads overall. Chemical engineering (20% of department heads), agricultural sciences (15%), and biological sciences (13%) were the only fields in which this recommendation occurred with any regularity.

In validation of the views of NSF's project advisors who recommended that the study be focused on equipment in the $10,000 to $1,000,000 range, this was the area of top priority need for 87 percent of the departments and facilities in the fields surveyed. Within this range, responses were split between departments/facilities that had the greatest need for "upgrading/expansion of equipment in the $10,000 - $50,000 range" (61%) and those whose greatest need was for "major shared-access instrument systems ($50,000 - $1,000,000) not presently available to department/facility members" (26%). (See Figure 3.) The latter need was especially prevalent in materials

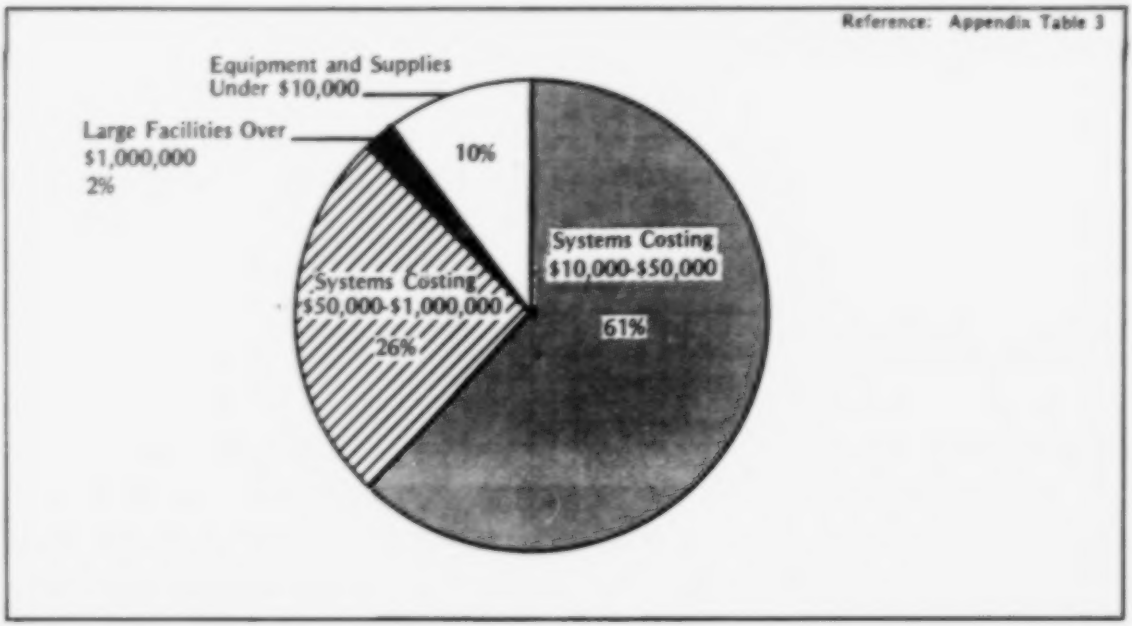

Figure 3. Department/facility top priority recommendation for increased Federal support of academic research equipment.

science (83%), materials engineering (62%), chemistry (54%), and electrical engineering (52%). In most fields and subfields, however, the predominant funding support need was for instrument systems in the $10,000 - $50,000 range (see Appendix Tables 3, 3A, and 3B).

The above findings are generally consistent with previously-reported anecdotal evidence. They suggest that, at the department level, concerns about inadequate instrumentation were of significant proportions, particularly in the physical and computer sciences and engineering. In those research fields, the belief was so widespread as to be essentially universal that instrumentation inadequacies have already reached the point of impairing academic scientists' abilities to work competitively at the frontiers of scientific knowledge. On the positive side, however, two noteworthy findings were: (1) in several subfields of the agricultural and biological sciences — especially those located in medical schools — a majority of department/facility heads assessed their existing equipment as adequate or better, and (2) in over 70 percent of the departments and facilities studied, the principal need is for equipment of comparatively modest unit cost — systems under $50,000.

2. THE NATIONAL STOCK

HIGHLIGHTS

- The 1982-83 national stock of academic research instrument systems was estimated to consist of approximately 47,000 instrument systems in the $10,000 to $1,000,000 range, with an aggregate purchase price of $1.6 billion.

- Not counting Federally-funded R&D Centers (FFRDCs), an additional 40 to 50 "super-systems" with unit costs over $1 million were estimated to exist in academic settings, with an aggregate cost of $250 million. Although details about these multi-million dollar systems were beyond the scope of this research, it was determined that most were used for research in high energy physics or astronomy.

- Even after the exclusion of multi-million dollar super-systems, the physical sciences had the largest 1982-83 stock of academic research equipment in terms of aggregate purchase price ($482 million), followed closely by the biological sciences ($471 million) and then engineering ($334 million). Together, these three broad fields contained 80 percent of the 1982-83 national stock.

- Only 8 percent of all systems priced between $10,000 and $1,000,000 cost $75,000 or more, but these "big ticket" systems accounted for 40 percent of the aggregate price of all surveyed equipment.

- About 80 percent of all systems in the 1982-83 national stock were actually used for research purposes during the survey year. The remaining 20 percent were physically present but were completely inactive or inoperable throughout the year, and were, presumably, obsolete.

- For systems in active research use, the user-reported aggregate replacement value was $1.9 billion, 40 percent above the aggregate purchase price of these instruments ($1.3 billion).

DISCUSSION

A major objective of the baseline equipment survey was to determine the actual amount of research equipment located in academic settings. This section highlights findings on that subject -- the overall size and cost of the "1982-83 national stock" of academic research equipment. In this analysis, the national stock refers to

all research instrument systems with an original purchase price of $10,000 - $1,000,000 (including all separately purchased components and dedicated accessories) that were physically present at the end of the survey year in all research departments and facilities in all research fields and institutions encompassed by the study. This includes systems that actually were used for research during the survey year, existing components of systems still under construction at the end of the year, and research systems that were present but totally inactive or inoperable throughout the year. For equipment in the agricultural, biological and environmental sciences, national stock was estimated as of December 31, 1983. For all other fields — those surveyed in Phase I — the national stock was estimated as of December 31, 1982.

Size of the 1982-83 National Stock

In the fields surveyed, the 1982-83 national stock of academic research equipment was estimated to consist of about 47,000 systems with an aggregate purchase price of $1.6 billion (see Appendix Table 4). The physical sciences had the greatest dollar amount of equipment in place ($482 million), followed next by the biological sciences ($471 million) and engineering ($334 million). The dominance of the physical sciences would have been even greater if the study had included instrument systems costing over $1 million. The study excluded 16 very large University-Administered Federally-funded R&D Centers (Oak Ridge, Lincoln Lab, Argonne, etc.), and extrapolation of findings from the survey sample indicated that there were an estimated 40 to 50 additional multi-million dollar "super-systems" in academic settings. These super-systems contained roughly $250 million in additional research equipment, almost all of which was used primarily for research in high energy physics or in astronomy.

The relative sizes of the equipment stocks in the various fields are shown in Figure 4, in terms of both percent of all systems in the national stock and percent of the aggregate purchase price of all systems in the national stock. Although the distributions for percent of systems and percent of aggregate price were quite similar, they were not always the same. The reason is that there were substantial differences among fields in the average unit price of in-place systems. Mean purchase prices ranged from $22,000 in the agricultural sciences to $54,000 per system in computer science (see Appendix Table 4.)

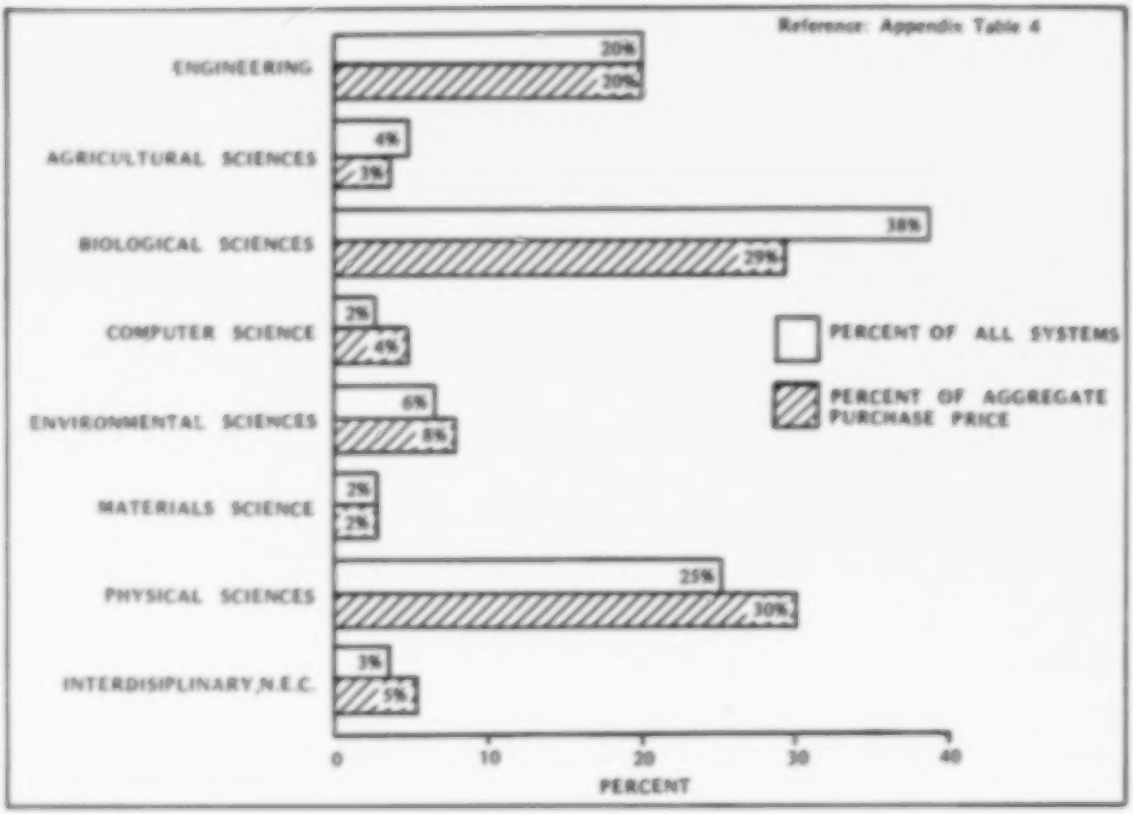

Figure 4. Distribution of the 1982-1983 national stock of academic research equipment, by field

Unitized Dollar Amounts of Research Equipment

Several "unitized" indices were calculated to express the comparative amount of equipment in a field per researcher or per other measure of the overall size of the research enterprise (see Appendix Table 5). On the indices examined, the physical sciences consistently had the greatest dollar amount of research equipment per unit (e.g., $25,000 of research equipment per faculty-level investigator) and the agricultural sciences had the least (e.g., $3,000 of equipment per investigator).

Overall, the mean dollar amount of research equipment in public institutions was about the same as in private institutions: $8.4 - $8.8 million per institution (see Appendix Table 6). In individual research fields, however, there were some significant differences. As shown in Figure 5, research equipment in the

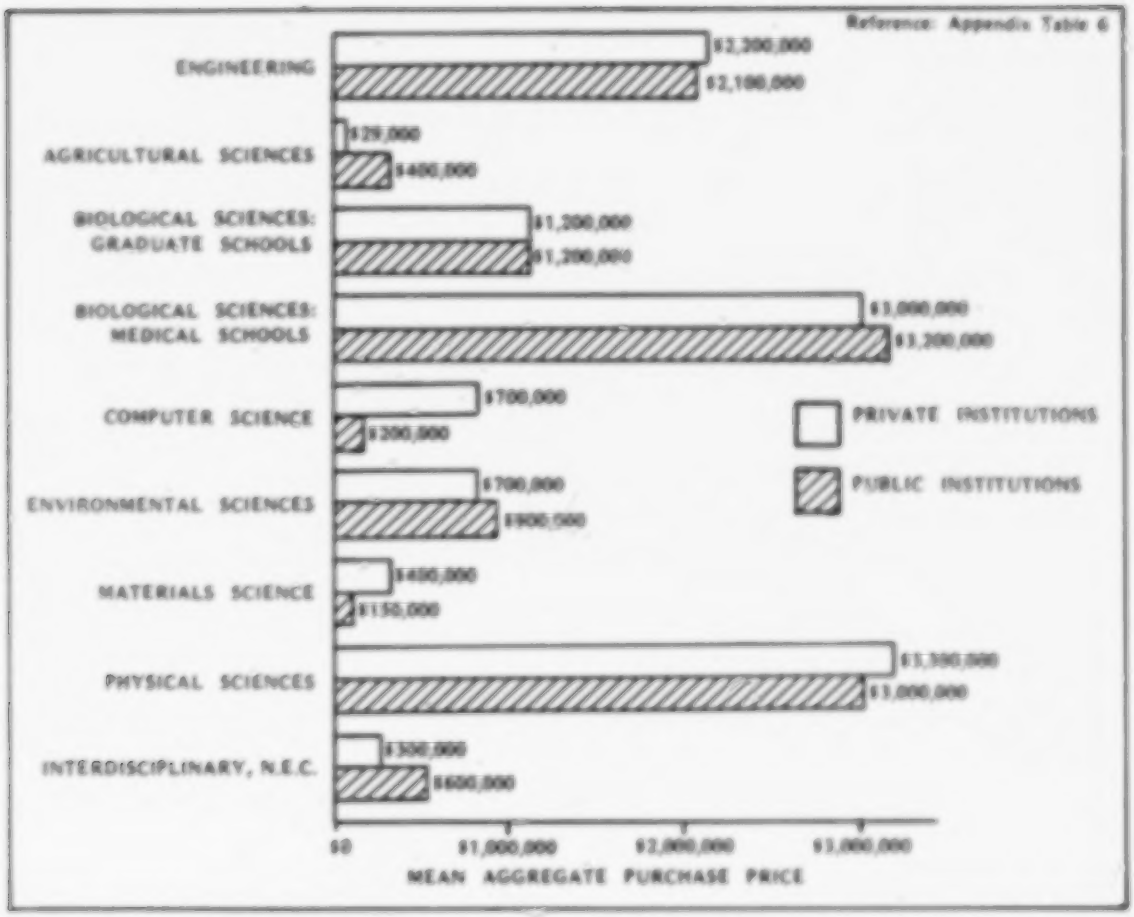

Figure 5. Mean dollar amount of research equipment per institution: Public vs. private institutions

agricultural sciences was located almost entirely in public sector institutions. Conversely, mean amounts of equipment per institution were much higher for private than public institutions in the fields of computer sciences and materials science.

System Purchase Price

Overall, there were comparatively few "big ticket" instrument systems in the national stock: only eight percent of all systems in the $10,000 - $1,000,000 cost range had unit costs of $75,000 or more. However, such systems accounted for a

substantial 40 percent of the aggregate purchase price of all systems in the national stock (see Figure 6). Systems in the $75,000 - $1,000,000 range were particularly dominant in the computer, materials, and environmental sciences, where they accounted for 54-57 percent of dollar amounts of equipment in these fields; by contrast, systems in this price range accounted for only 12-24 percent of the dollar amounts of research equipment in the agricultural and biological sciences (see Appendix Table 8).

In-use Research Equipment

In the equipment survey, detailed user-reported information about individual instrument systems was obtained only for systems that had actually been used for research during the survey year. This in-use component encompassed about 80 percent of the 1982-83 national stock in terms of both percent of systems and percent of aggregate price (see Appendix Tables 9-10). Information about the aggregate

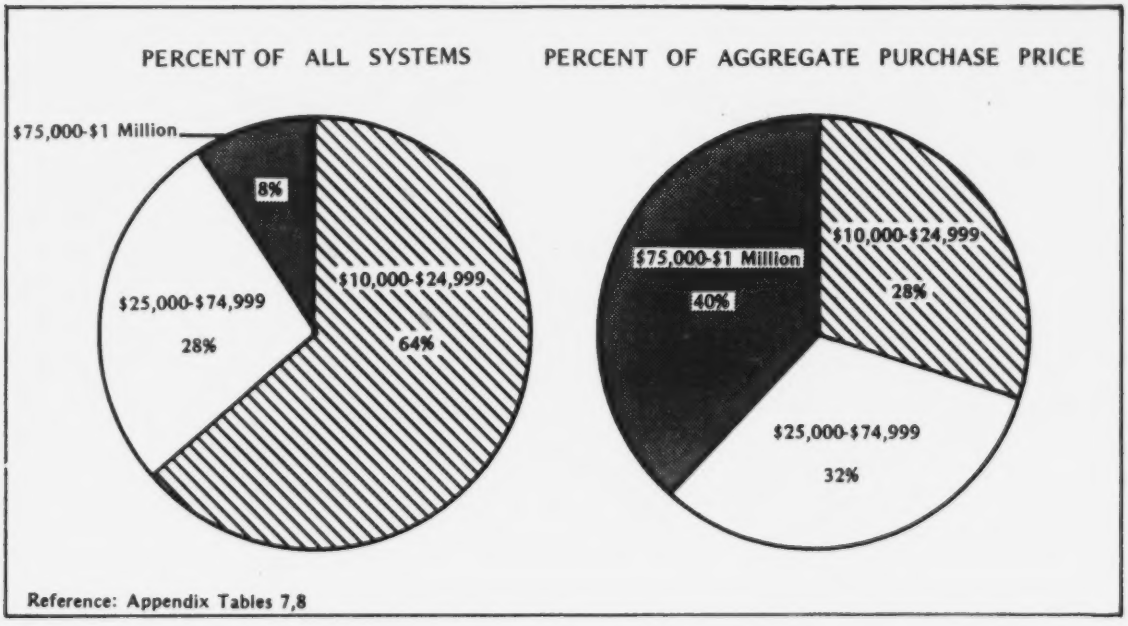

Figure 6. Distribution of 1982-1983 national stock of academic research equipment by system cost range

price/value of in-use equipment is presented in Figure 7, which shows that in-use equipment had an aggregate original list price — or purchase price — of $1.32 billion, roughly 80 percent of the $1.63 billion represented in the full national stock.

For individual instruments, the system acquisition cost (the actual price paid to obtain the system) could be considerably different from the original purchase (list) price. When aggregated across all in-use equipment, however, the two figures were very similar: $1.24 billion in acquisition cost vs. $1.32 billion in purchase price. As would be expected, the user-reported replacement value of all in-use equipment (the estimated current dollar cost of the same or functionally equivalent equipment) is considerably higher than either original cost index; in fact, the aggregate replacement value was exactly 50 percent greater than the aggregate acquisition cost ($1.86 billion vs. $1.24 billion).

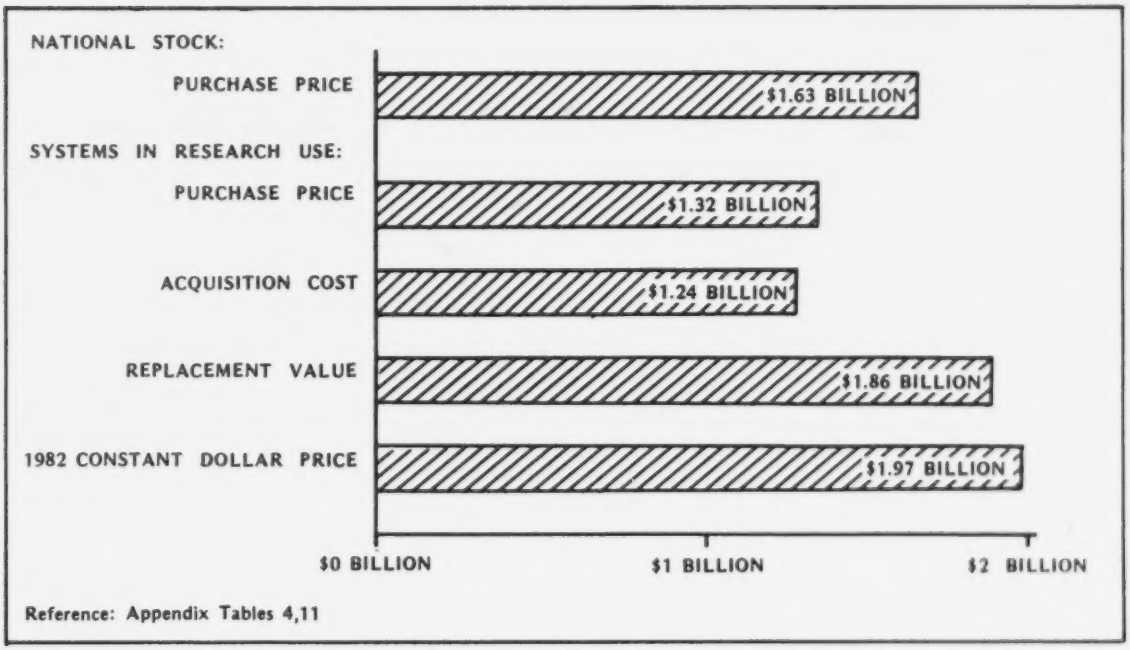

Figure 7. Indices of the cost/value of the full national stock and of systems in research use during the survey year

One might assume that the difference between original cost and current replacement value would largely be attributed to inflation. Consistent with this assumption, applying a simple inflation adjustment to convert original purchase prices to 1982 constant-dollars had roughly the same effect as asking the instrument's principal research users to estimate current replacement values (see Appendix Table 11; see also Technical Notes for inflation adjustment procedure).

3. ANNUAL EXPENDITURES

HIGHLIGHTS

- In the fields studied, annual investment during the survey year for purchase of nonexpendable academic research equipment costing $500 or more per unit totalled $414 million.

- This annual investment represented an overall average of $8,200 per full-time equivalent faculty-level researcher. Computer science had the highest instrumentation investment level ($12,700 per researcher); the agricultural sciences were lowest ($4,300 per researcher).

- This current annual level of equipment investment also represented fully 25 percent of the aggregate purchase price of the entire national stock of $10,000 - $1,000,000 research instrument systems in the fields surveyed.

- In addition to their expenditures for purchase of additional research equipment, academic departments and facilities spent substantial amounts during the survey year for maintenance and repair of existing equipment (over $100 million) and for purchase of research-related computer services (over $120 million). Total instrumentation-related expenditures ($640 million) were equivalent to an average of $1.2 million per year per institution for medical schools (biological sciences departments only) and $3.4 million per year per institution for universities exclusive of medical schools.

DISCUSSION

This section presents survey findings concerning department heads' current and projected annual levels of investments in nonexpendable research equipment costing $500 or more per unit and in other equipment-related cost areas. For Phase I fields, "current year" or "survey year" estimates refer to FY 1982. For Phase II fields, such estimates are for FY 1983.

In the fields surveyed, an estimated $414 million was invested during the survey year in academic research equipment costing $500 and over (see Appendix Table 13). Overall and in most individual fields, this represented about 25 percent of

the aggregate purchase prices of all $10,000 - $1,000,000 research equipment in the 1982-1983 national stock (compare to Appendix Table 4).

In addition to direct outlays for equipment purchases, an estimated $121 million was spent to purchase research-related computer services during the survey year and $105 million was spent for maintenance and repair of existing research equipment (see Figure 8).

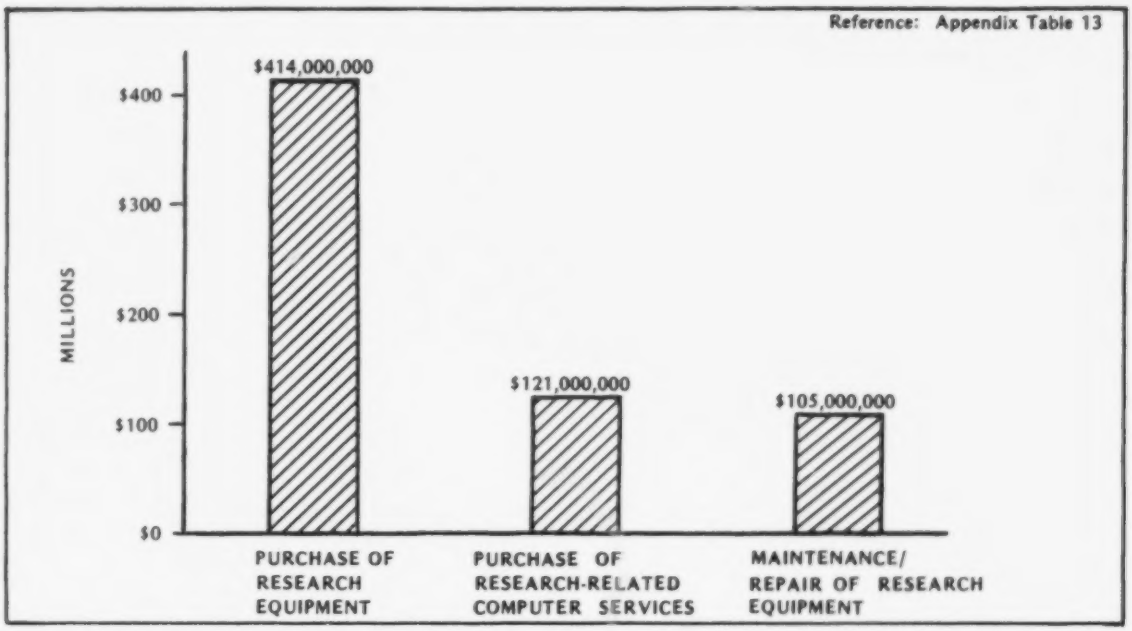

Figure 8. Annual instrumentation-related expenditures in academic departments and facilities

Current fiscal year equipment investments are compared to projected next-year investments in Appendix Table 14. Although there was very little net difference between current and projected investment levels, much fluctuation both among broad fields and among subfields was found. Among the broad fields, computer science projected the greatest one-year growth in expenditures for research equipment (+66%), and the agricultural sciences projected the greatest decline (-31%). Biological science departments that were located in medical schools also projected a significant drop in equipment expenditures from FY 1983 to FY 1984 (-35%).

Current year equipment expenditures were converted to mean expenditures levels per institution, per department/facility and per faculty-level investigator (see Appendix Table 15). The 157 largest R&D universities in the study universe spent an estimated average of $2.1 million per institution for research equipment during the survey year, exclusive of medical schools. Medical schools spent an estimated mean of $875,000 per institution in FY 1983 for purchase of research equipment in their biological science departments and facilities. (This does not include equipment purchases in medical school clinical departments.)

Materials sciences research facilities averaged $.5 million in annual equipment expenditures per facility, much higher than for any other department/facility category. On the other hand, mean expenditures per university were lower for materials sciences than for any other category, indicating that the category contains a small number of large, specialized instrumentation facilities — fewer than one per institution.

Mean expenditures per faculty-level investigator are shown in Figure 9. Consistent with other indicators of relative equipment intensiveness it may be seen that computer sciences had the highest current equipment expenditure level ($12,700 per investigator), while the agricultural sciences were lowest ($4,300 per investigator).

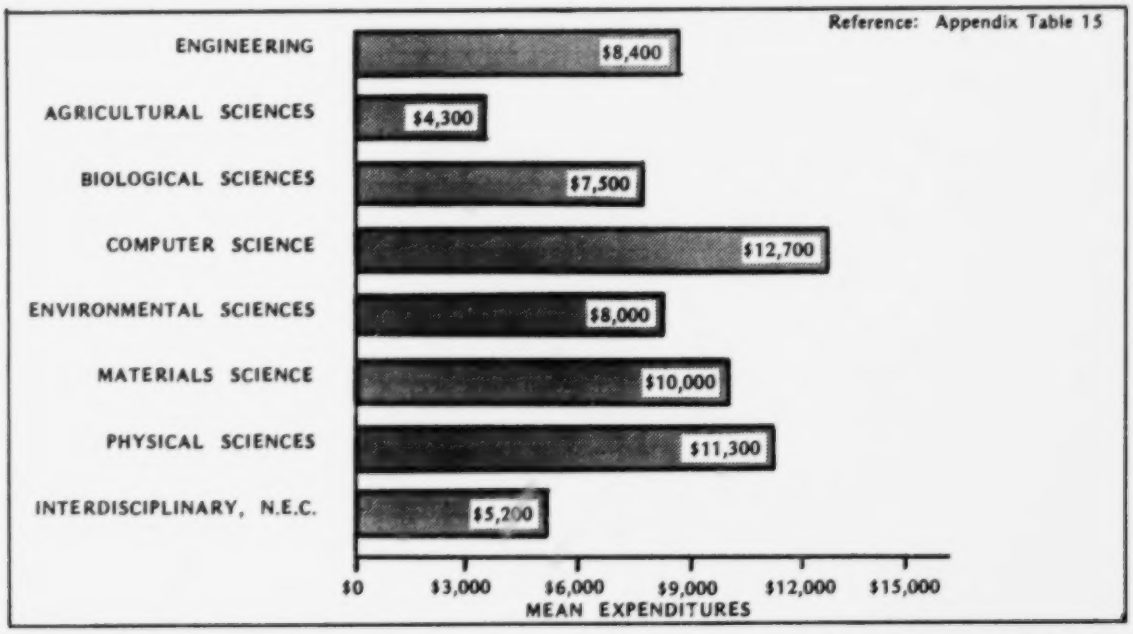

Figure 9. Mean annual expenditures per faculty-level investigator for purchase of research equipment, by field

4. RESEARCH STATUS, AGE, AND CONDITION

HIGHLIGHTS

- One in every five instrument systems in the national stock had been completely inoperable or inactive throughout the year of the survey and was, in effect, obsolete. For the physical sciences and engineering, the ratio was almost one in four.

- Forty-seven percent of all instrument systems in the national stock were acquired within the 5 year period prior to the survey, while 29 percent were more than 10 years old.

- Computer science had the newest equipment, with 81 percent acquired in the previous 5 years. Materials science had the oldest equipment: 52 percent of the systems were over 10 years old.

- Only 17 percent of instrument systems in the national stock were state-of-the-art. Of all that were in active research use but were not state-of-the-art, nearly half (46%) were the most advanced instruments to which their users had access.

- State-of-the-art instrument systems were newer (median age = 3 years), than all other systems in active research use (median age = 6 years). They were also more costly.

- While 84 percent of state-of-the-art instrument systems were rated as being in excellent working condition, only 43 percent of in-use but not state-of-the-art systems were in excellent condition.

- As might be expected, working condition tended to deteriorate with age; two-thirds of the instruments over five years old and still in use were not in excellent condition, while two-thirds of those under five years old were rated excellent.

DISCUSSION

This section presents findings on the age and research status of all instruments in the national stock and on the age and operating condition of those systems that were in active research use, as reported by their users.

Instrument Research Status

The distribution of instrument systems in the national stock according to their research status is shown in Figure 10. Overall, 20 percent, or one in five of all instruments, were no longer in research use, although they were still listed on property inventories. An additional 2 percent were being prepared for use in the laboratory and not yet in service. All the rest, 78 percent of the national stock, were in active research use.

Some variation was found among the fields of research in the rate of obsolescence. For engineering and the physical sciences, 23 to 24 percent of the instrument systems in the national stock were not in use, or nearly one in four. In the biological and agricultural sciences, and computer science, the proportion no longer in research use was 14 to 15 percent, which is about one in seven instruments. Two subfields of research had unusually high proportions of obsolete instruments: electrical engineering (31%) and general biology (33%). (See Appendix Tables 9, 9A, and 9B.)

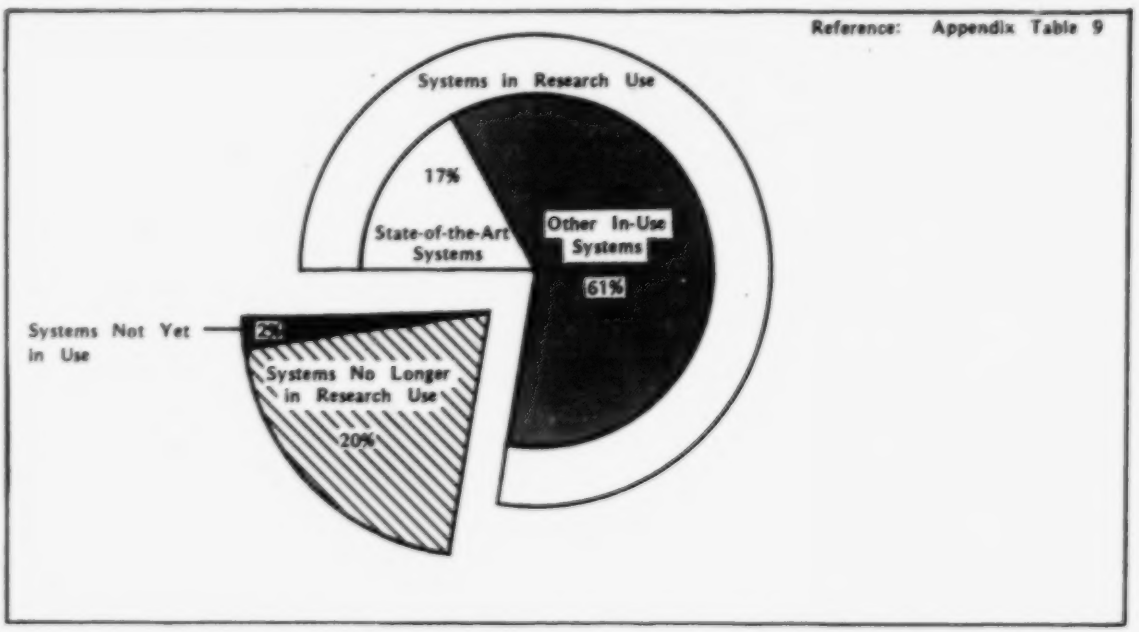

Figure 10. Research status of instrument systems in 1982-83 national stock

An important segment of those in active use are the state-of-the-art instruments, 17 percent of the national stock. While the major fields of research displayed little variation in proportion of state-of-the-art instruments, one subfield -- molecular/cellular biology — stood above all others with 28 percent so classified. (See Appendix Tables 9 and 9B.)

Age of Research Equipment

The median age of all instruments in the national stock was six years. For state-of-the-art instruments it was three years, and for other instruments in research use it was six years. For instruments no longer in research use the median age was 12 years. (See Figure 11.)

Among the fields of research the range of median ages was 3 years for computer science to 11 years for materials science. For the subfields, pathology, general biology, and other miscellaneous engineering fields all had the highest median age, eight years. (See Appendix Tables 21, 21A, and 21B.)

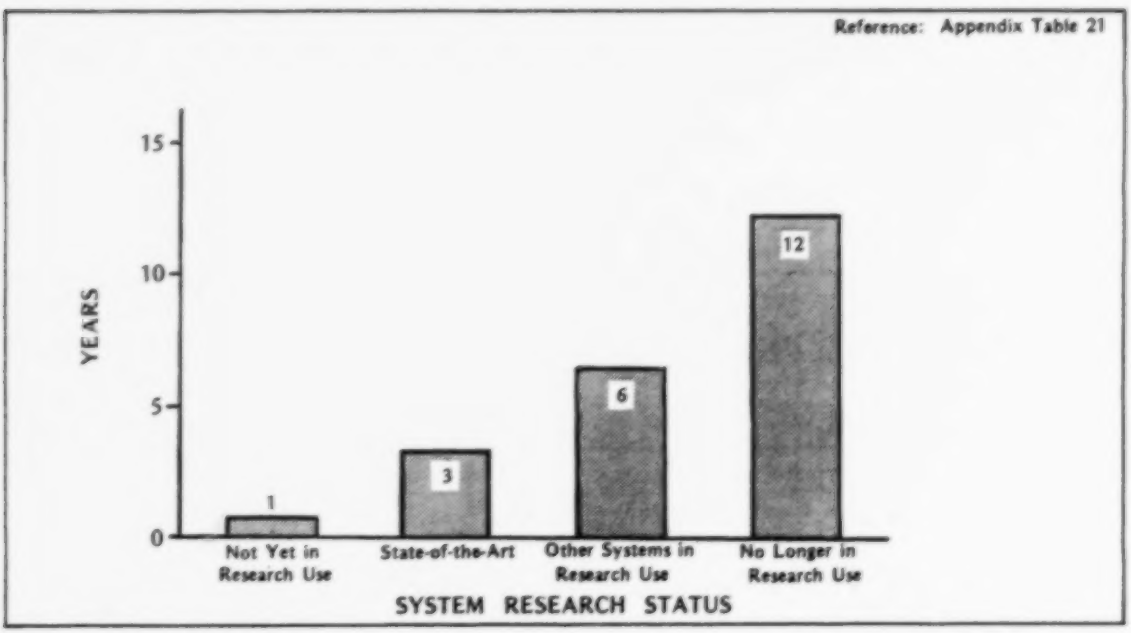

Figure 11. Median age of academic research instruments, by research status

Of all instrument systems in the national stock, 29 percent were acquired more than 10 years prior to the date of the survey, while 47 percent were purchased from 1 to 5 years before the survey. Computer science had far more new equipment than any other field, with 81 percent from 1 to 5 years old and 11 percent over 10 years old. This reflects the rapid build-up of the field in recent years. On the other hand, 52 percent of the instruments in materials science were over 10 years old, much more than any other field. (See Appendix Table 16.)

The subfield with the greatest proportion of one- to five-year-old instruments was electrical engineering (64%). Those with the largest proportions of instruments over 10 years old were anatomy (40%), physics/astronomy (39%), civil engineering (38%), and mechanical engineering (37%). (See Appendix Tables 16A and 16B.)

Instrument systems in active research use are all that remain after eliminating the technologically or mechanically obsolete and those still being prepared for use. The proportion of instruments actively used for research that was over 10 years old was 22 percent, and for those from 1 to 5 years it was 53 percent. (See Appendix Table 19.) They include both state-of-the-art instruments and others in active use; 22 percent were state-of-the-art.

Figure 12 displays the percent of instruments that were over 10 years old, comparing the national stock with instruments in use, for each field. With the elimination of instruments no longer in use, the proportion of older instruments was reduced for every field, most sharply for interdisciplinary -- a drop from 42 percent to 16 percent. Computer science, with only 11 percent over 10 years old in the national stock, had only 1 percent in actual use in the older group.

State-of-the-Art Instrument Systems

Instruments that are considered state-of-the-art are of special interest to the scientific community. They are both newer and more costly than the rest of the instruments in the national stock and apparently lose their designation as state-of-the-art within a few years after purchase. For all instruments for which purchase dates

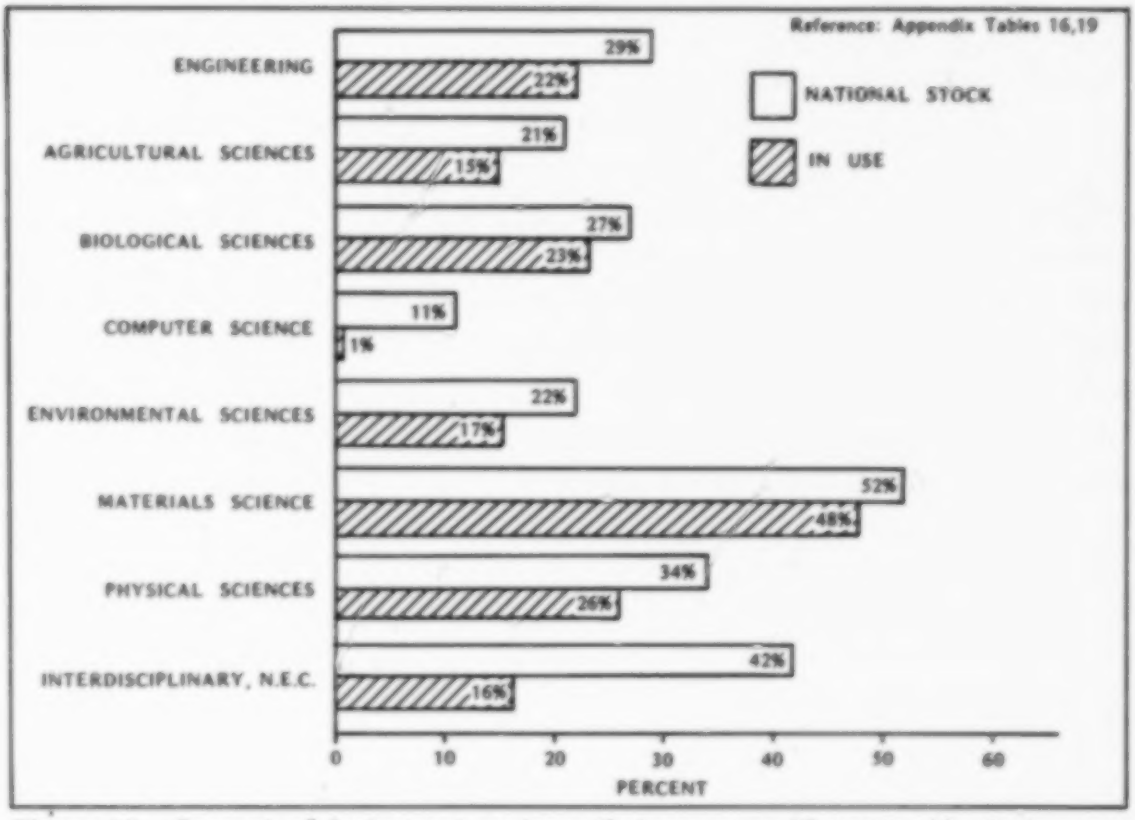

Figure 12. Percent of instrument systems that are over 10 years old: Instruments in national stock and in active research use

could be obtained, 18 percent were state-of-the-art. Examining them by year of purchase, 43 percent of all systems in their first year of service were state-of-the-art, 32 percent of those in service for three years, 15 percent of those for five years, and very small percentages for those over five years. (See Appendix Table 18.) This decline in status as state-of-the-art is illustrated in Figure 13.

Eighty-two percent of state-of-the-art instruments were 1 to 5 years old (Appendix Table 20), compared to 53 percent for all instruments in research use (Appendix Table 20). Thus, only 45 percent of other instruments in use were in that age range.

It has been noted that the median age of state-of-the-art instruments was three years, compared to six years for all other instruments in research use. The field

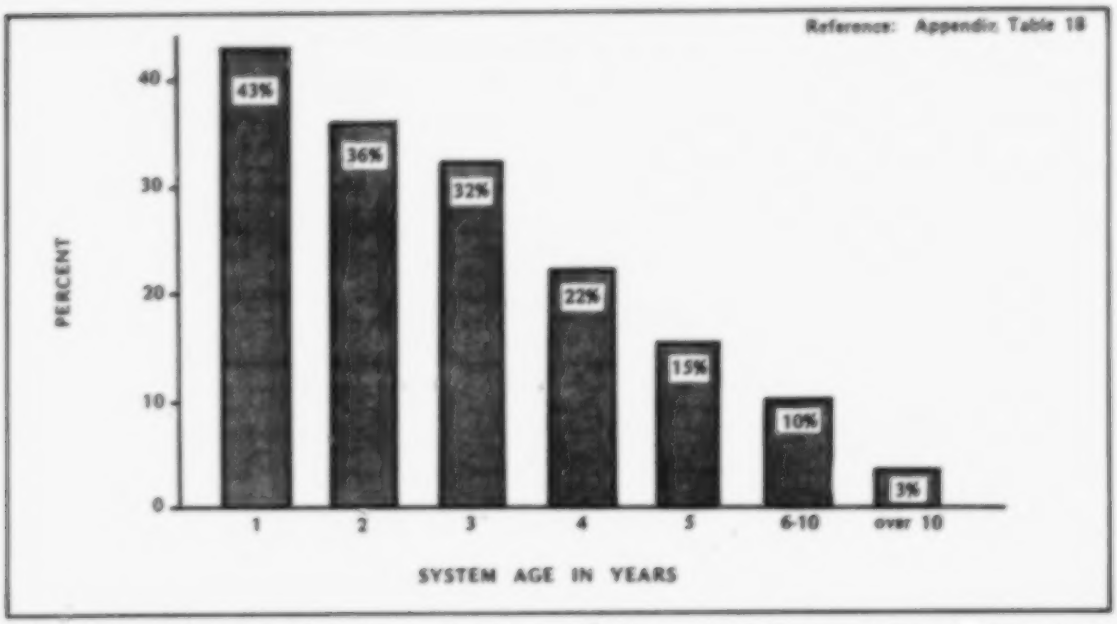

Figure 13. Percent of systems in the national stock that are state-of-the-art, by age of system

of computer science is exceptional, with a median age of one year for state-of-the-art instruments and three years for all others in research use. Technological change in this field is very rapid, and the median ages reflect this.

As for costs, of all systems with a purchase price between $75,000 and $1 million, 28 percent were state-of-the-art. Of those costing between $10,000 and $24,999, only 14 percent were state-of-the-art. (See Appendix Table 17.) For medical schools in the biological sciences the difference is particularly large, with 43 percent of the costly items being state-of-the-art, compared to 18 percent for the least costly. Biological science in the graduate schools does not display the same large difference, tending to conform to the other fields. Materials science also had a very large difference, with 31 percent and 6 percent for the most and least costly instruments respectively. Interdisciplinary, on the other hand, showed no difference between the cost levels.

There is an underlying element that contributes to the higher cost levels for state-of-the-art instruments. Inflation was a significant factor over the years during which the instruments in this survey were purchased, so that the cost of an instrument

-- all other things being equal -- became progressively higher each year. Recently purchased equipment such as the great majority of state-of-the-art instruments, was more expensive for this reason, although that may not be the only cause.

Condition of Instrument Systems

About half (52%) of all systems in research use were judged by their principal users to be in excellent working condition, and 10 percent in poor condition. Predictably, age of the instrument is strongly related to its working condition. Two-thirds of instruments from one to five years old were in excellent condition, while only one-third of those over five years old were so rated. (See Figure 14 and Appendix Table 22.)

All fields of research reported about the same proportions for instruments in excellent condition -- approximately 50 percent -- except for materials science,

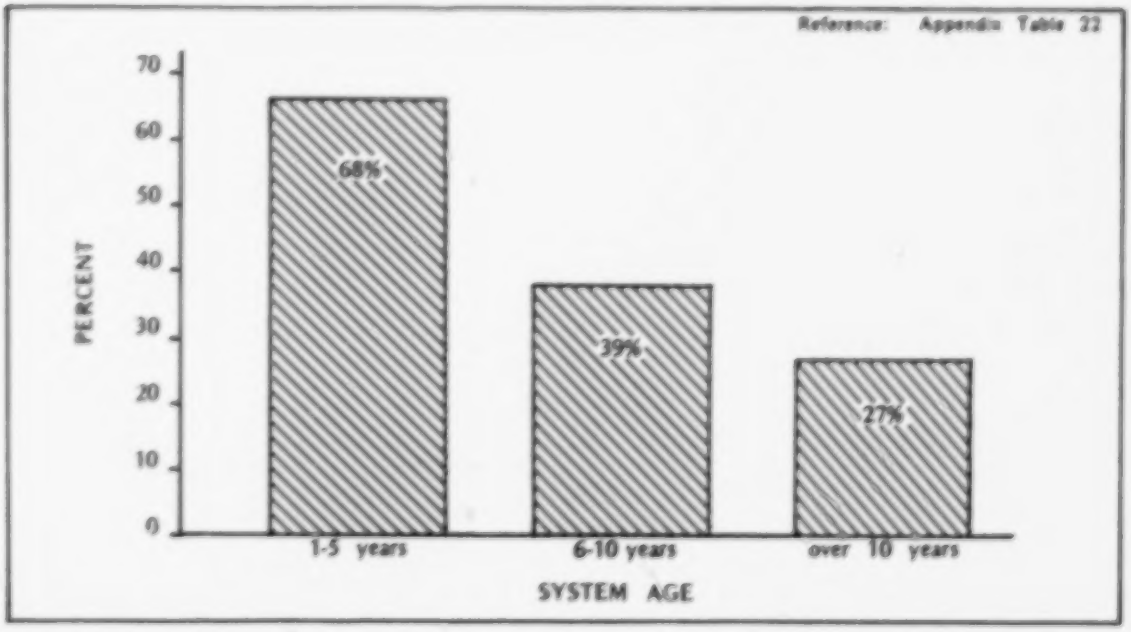

Figure 14. Percent of systems in excellent working condition, by age

with only 32 percent. Two subfields, chemical and civil engineering, were also low on this index, with 39 and 37 percent respectively in excellent condition. (See Appendix Tables 23 and 23A.)

State-of-the-art systems had 84 percent in excellent working condition. By contrast, only 43 percent of other instruments in research use were in excellent condition. (See Appendix Table 23.) These other than state-of-the-art instruments constituted nearly 80 percent of all instruments in research use.

By itself, the existence of a substantial amount of non-state-of-the-art equipment may not be a problem. Even the best equipped laboratories would be expected to have a good many such instruments for use in routine analyses, as backups for more advanced instruments, etc. Non-state-of-the-art equipment becomes a problem in situations where its users do not have access to more advanced equipment when needed. This problem situation is not uncommon, however; nearly half (46%) of all non-state-of-the-art instrument systems in research use were the most advanced instruments of their kind to which their research users had access. (See Appendix Table 24.)

For engineering, computer science, physical sciences, environmental sciences and agricultural sciences about half or more of their instruments are in the category of non-state-of-the-art, but most advanced available. Only in materials science and interdisciplinary do researchers using non-state-of-the-art equipment have frequent access to more advanced instruments. (See Figure 15.)

A question can be raised about the adequacy of research instrumentation when half of the equipment is in some state of disrepair (i.e., in less than excellent working condition) and when nearly half of the instruments that are non-state-of-the-art are the most advanced to which investigators have access -- especially when these non-state-of-the-art instruments make up nearly 80 percent of all research instruments in use.

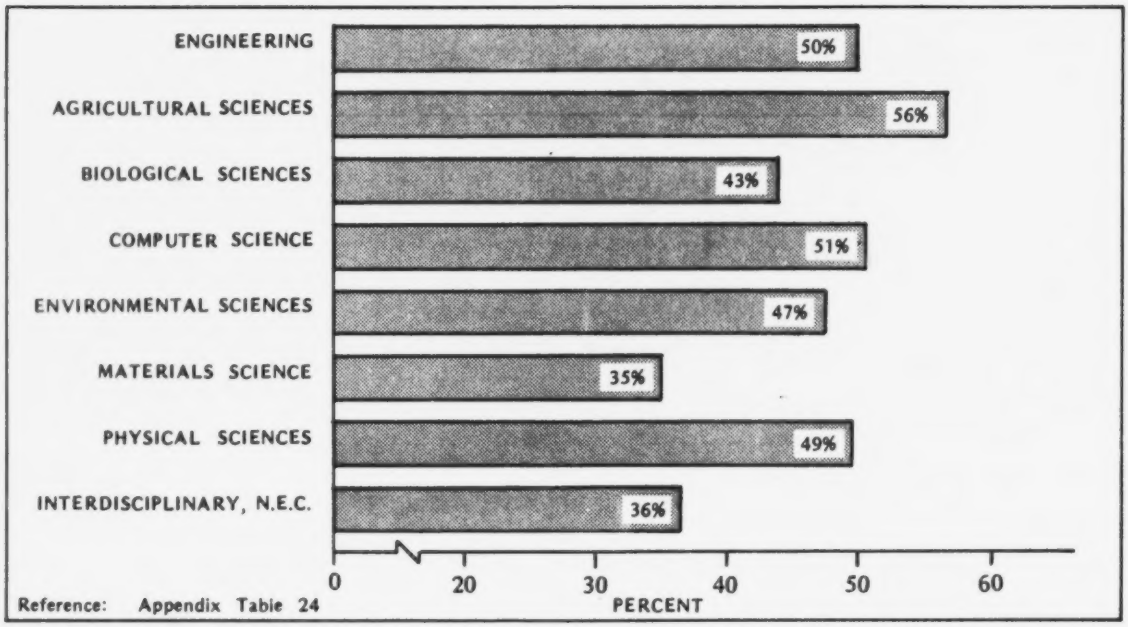

Figure 15. Percent of in-use but non-state-of-the-art systems that are the most advanced to which their users have access, by field

5. FUNDING SOURCES

HIGHLIGHTS

- Fifty-four (54) percent of the funds for acquisition of in-use academic research equipment came from Federal sources, 32 percent from the universities themselves.
- Eighty-nine (89) percent of the equipment was purchased new. About 5 percent was not "funded" in the usual sense: some equipment was acquired at no cost from government surplus, some was donated, and some was transferred by incoming faculty.
- The leading Federal funding sources were NSF, which provided 20 percent of the aggregate acquisition costs, and NIH, with 15 percent.
- Joint Federal/non-Federal funding occurred in 18 percent of the instrument systems purchased. No Federal funds were used for 38 percent of all systems.

DISCUSSION

This section is devoted to the acquisition of academic research equipment, including how it including how it was acquired and what sources supplied the funding.

Means of Acquisition

Most research equipment (89%) was purchased new. About five percent was acquired through donations, Federal surplus, or transfer as faculty with ongoing research projects joined the staff.

There were some differences among the fields of research in how they acquired equipment. New purchases accounted for 94 to 95 percent of all instrument systems in the agricultural, biological, and materials sciences. For engineering and environmental sciences 83 percent were new purchases. Locally built instrument

systems were found in a few subfields: mechanical engineering (11%); physics/ astronomy (8%); and electrical engineering (7%). Donations accounted for only 2 percent of all instruments, but for computer science 6 percent were donated, electrical engineering 6 percent, and other miscellaneous engineering 11 percent. (See Appendix Tables 25 and 25A.)

Sources of Funding

While the largest funding source for academic research equipment was the Federal Government, with 54 percent of all funds, the universities themselves supplied 32 percent. Business and industry provided 4 percent, and other sources -- including private foundations -- contributed 5 percent. The two Federal agencies providing the most funds were NSF (20%) and NIH (15%). (See Appendix Table 26.) Figure 16 illustrates the amounts contributed by each source.

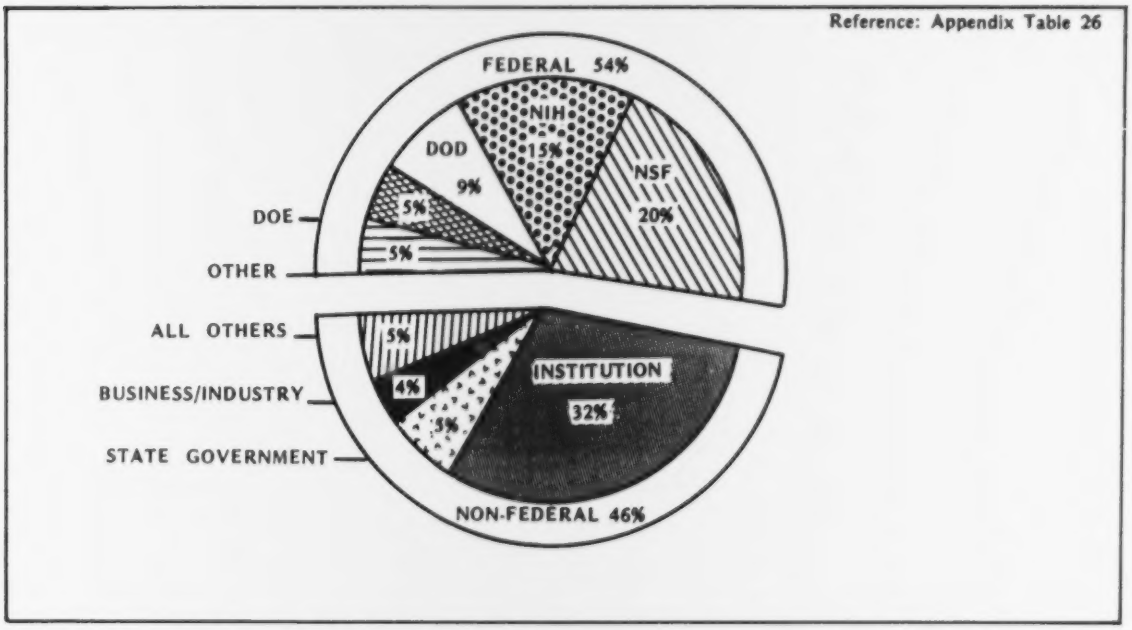

Figure 16. Sources of funds for acquisition of in-use research equipment

Total Federal funding for the fields of research is shown in Figure 17. Federal agencies supplied 71 percent of the funds for materials science and 65 percent of funds for physical sciences, but only 21 percent of those for agricultural sciences.

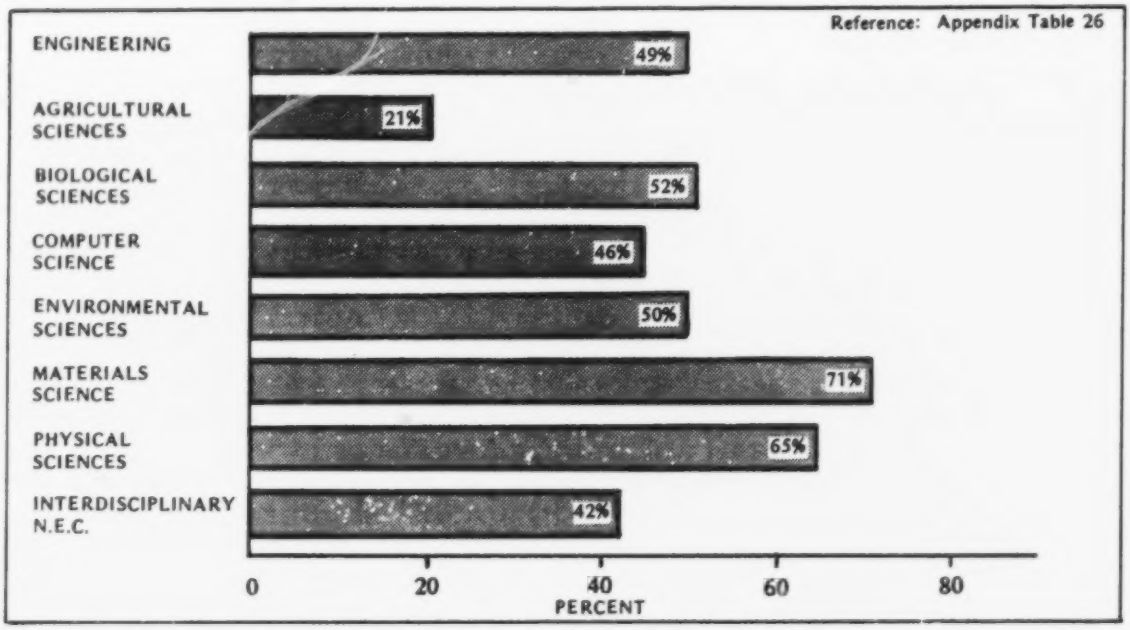

Figure 17. Percent of aggregate instrument acquisition funds obtained from Federal sources, by field

Each field had a unique pattern of funding sources from Federal agencies, as shown in Figure 18. Biological sciences received most of its Federal equipment money from NIH, physical and materials sciences from NSF, and engineering and computer sciences from both NSF and the Department of Defense.

Among the non-Federal sources, funds from business and industry impacted most strongly on computer science, with 16 percent coming from those sources. Agricultural sciences obtained 49 percent of its funds from their universities and 18 percent from state governments — the largest proportions of contributions from those sources. Institutional funds, however, were a significant proportion of funding for all fields.

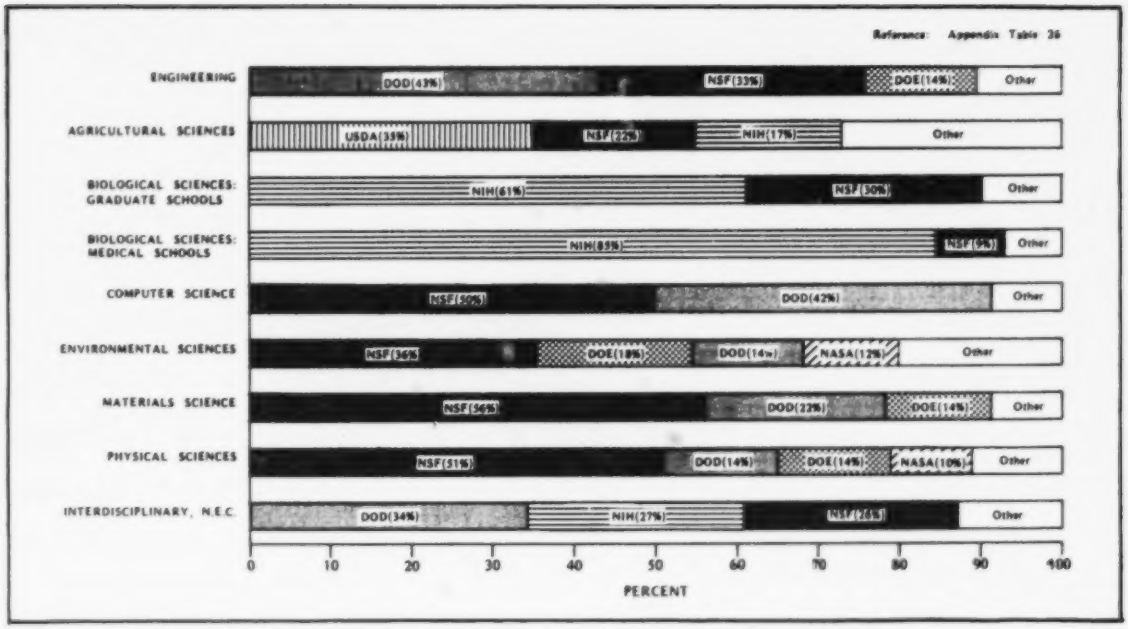

Figure 18. Percent of Federal component of aggregate acquisition cost of in-use research instruments, by field

Appendix Table 27 shows how each funding source distributed its awards among the fields. NIH allocated almost all of its equipment funding (85%) to the biological sciences. NSF's funds were directed principally to physical sciences (36%) and biological sciences (31%). NASA's funds went largely to the physical sciences (73%), and Department of Defense funds to engineering (44%) and physical sciences (31%). Business contributions went mostly to engineering (30%), environmental sciences (19%), and computer science (18%). University funds were distributed in a pattern roughly proportional to the total funding for each field.

In Appendix Table 28 will be found an analysis of funding sources by system purchase cost. Overall, 28 percent of the funds was spent for systems costing between $10,000 and $24,999, and 41 percent for those costing between $75,000 and $1 million. However, NSF funds were directed disproportionately to the more costly instruments, with 19 percent for the least costly and 51 percent for the most expensive. Most other sources followed this pattern, but NIH and the Department of Agriculture displayed the reverse of the pattern, with the least costly instruments getting the larger share of those agencies' equipment funds.

Appendix Table 28 also reveals that private and public institutions had different funding patterns of sources. Thirty-six percent of all funds went to private institutions, but they received 42 percent of all Federal funds and 57 percent of all business funds, while receiving only 30 percent of institutional funds. The reverse was true, of course, for public institutions, with less from Federal agencies than their 64 percent of all funds and more of the institutional funds.

Joint Funding of Equipment

Shared funding of equipment costs between Federal and non-Federal sources was achieved in 18 percent of all instruments purchased. This occurred more frequently for materials science (32% of all purchases), computer science (29%), and physical sciences (27%), but in only 10 to 12 percent of the purchases in biological and agricultural sciences. (See Appendix Table 29.)

Overall, 44 percent of all instruments received 100 percent Federal funding and 38 percent received no Federal funds at all. Non-Federal sources provided 72 percent of the funding for instruments in the agricultural sciences, far more than for any other field. At the other extreme, only 13 percent of instruments for materials science and 24 percent of those for physical sciences had no Federal funding.

Looking at Federal funding by year of purchase (Appendix Table 30), the proportion of instruments purchased at least in part with Federal funds decreased in 1982 and 1983 to 45 and 55 percent of all instruments respectively, from more than 60 percent in each of the eight preceding years. The reasons for this trend are not clear.

6. LOCATION AND USAGE

HIGHLIGHTS

- Forty-one (41) percent of instrument systems were located in shared-access facilities; the rest were located in within-department laboratories of individual principal investigators.
- Most computer science and materials science equipment was located in shared-access facilities.
- One instrument in four (27%) of all in-use instrument systems was dedicated for use in a particular experiment or series of experiments and not amenable to general usage. In some areas of research (physics and astronomy, chemical engineering) half of the systems were dedicated.
- Location of equipment was strongly related to cost, with the most expensive equipment most likely to be located in shared-access facilities. Older equipment was somewhat more likely to be in shared-access facilities than those more recently purchased.
- For equipment in use, the mean number of users per system was 14. The mean number of users for dedicated systems was 8, and for general purpose equipment it was 16.
- Thirty-four (34) percent of all in-use systems were used at some time by researchers from the same institution but outside the host department or facility.
- Widespread usage by researchers from outside the host department, as well as from other universities and nonacademic laboratories, was common for instrument systems at the upper end of the cost range.

DISCUSSION

The extent to which research equipment is shared among several investigators is covered in this section. Included are such questions as: In what kinds of laboratories are instruments located? How many research personnel use the typical instrument? What types of researchers use them? To what extent are instruments dedicated to very specialized experiments and not readily adapted to more general use?

Location of Equipment

Overall, 59 percent of research instrument systems were housed in the laboratories of individual investigators, with the remainder in various types of shared-access laboratories. Most common among the latter group was the department-managed common laboratory, with 32 percent of all instruments. Institutional facilities that were not within the departmental structure contained six percent. National or regional laboratories had one percent, as did other kinds of shared-access facilities. (See Appendix Table 31.)

While most fields had from 50 to 65 percent of their systems in individual laboratories, two fields were different. Computer science had about two-thirds of its systems in department-managed, common laboratories, and another 14 percent in nondepartmental facilities, with only 19 percent in individual laboratories. Materials science, while also having 19 percent in individual laboratories, had 48 percent in nondepartmental facilities, since materials science is found mainly in separately funded, nondepartmental units managed by a few universities. Figure 19 shows the percent of instrument systems in a shared-access facility, by fields.

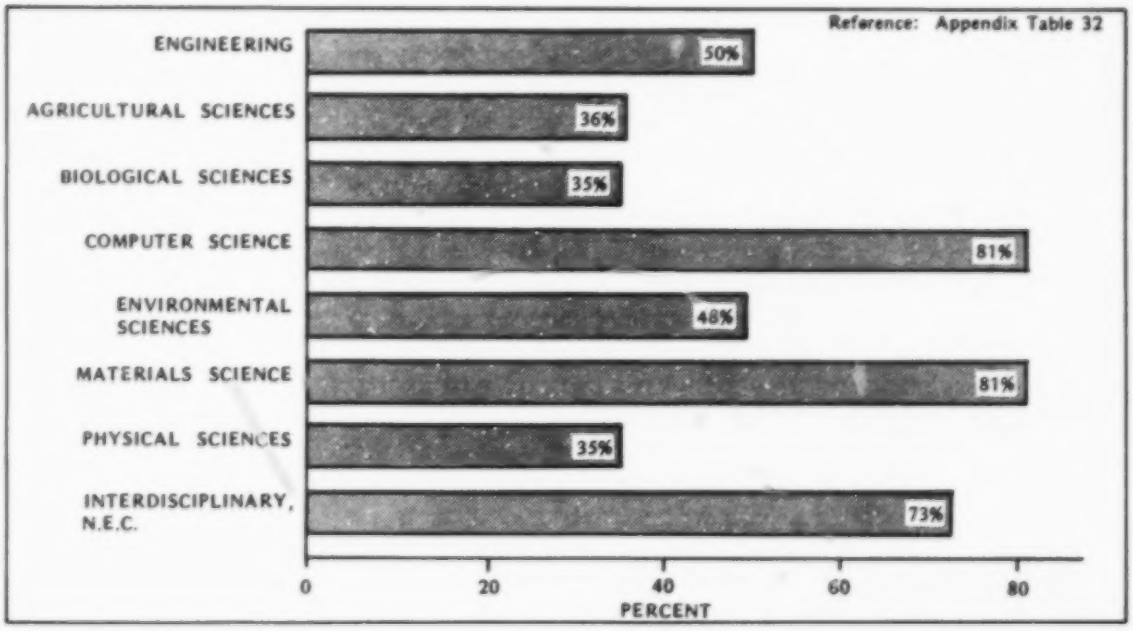

Figure 19. Percent of in-use systems located in shared-access facilities, by field

Subfields within the same general field differ in the division of their instruments between individual and shared laboratories. Chemistry, for example, placed 30 percent of its systems in common laboratories, while physics/astronomy had 17 percent; they had 62 and 69 percent, respectively, within individual laboratories. Engineering, civil engineering and the other miscellaneous subfields had more than half in common laboratories, while chemical and electrical engineering had large proportions within individual laboratories. In the biological sciences, the subfields of anatomy, food/nutrition, and microbiology each had well over 40 percent of their instruments in shared-access facilities; the remaining subfields concentrated large percentages in individual laboratories.

There was very little difference between state-of-the-art and other instruments as to whether they were in shared-access laboratories. (See Appendix Table 32.)

System purchase price was related to placement of an instrument in a shared-access facility. Thirty-six percent of the instruments costing between $10,000 and $24,999 were in shared-access facilities, while 60 percent of those purchased for between $75,000 and $1 million were in such locations. (See Appendix Table 33.) All of the fields followed this pattern to a greater or lesser degree, as did nearly all of the subfields. Figure 20 illustrates this relationship.

Age of the system was moderately related to placement in shared-access facilities, with 38 percent of the instruments that were 1 to 5 years old in such locations, while 48 percent of those over 10 years old were so located. Engineering displayed this pattern strongly, but mainly because of the subfields of mechanical, metallurgical, and other miscellaneous engineering. Computer and materials sciences also had a strong correlation between age of instruments and their placement in shared-access facilities, while most other fields showed weak trends. (See Appendix Tables 34 and 34A.)

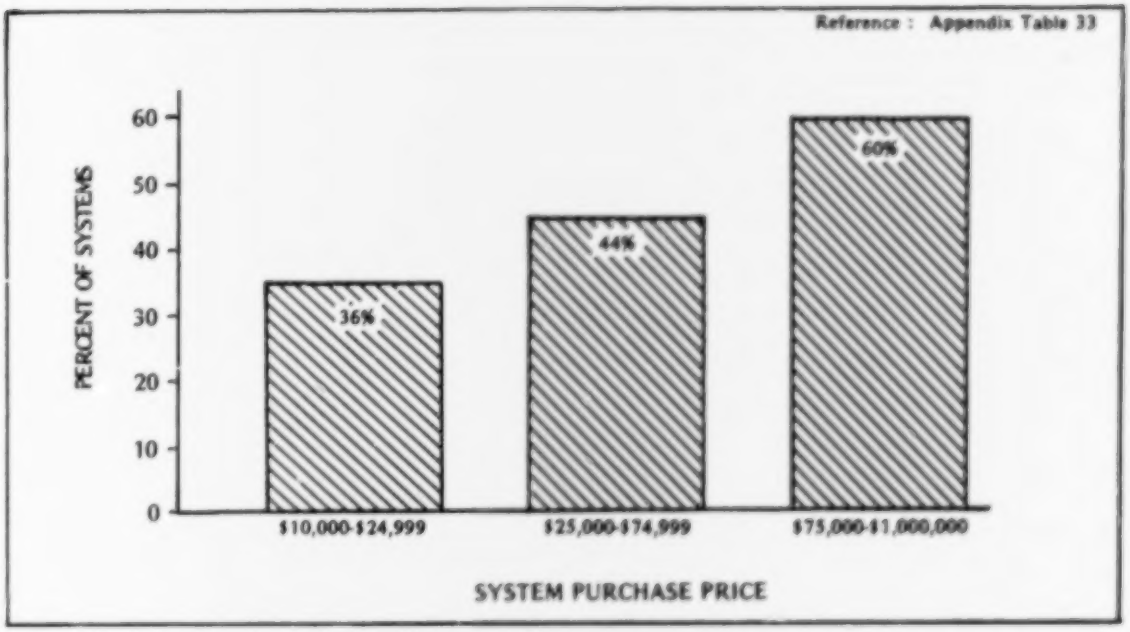

Figure 20. Percent of in-use systems located in shared-access facilities, by purchase price

Dedicated Instruments

For some experiments or series of experiments it is necessary to calibrate one or more instruments, or to assemble several instruments in a special configuration, leaving them undisturbed for the duration of the research project. These systems then become unavailable for general purpose use until they are released. These instruments are referred to as "dedicated" instruments; the remainder are called "general purpose" instruments.

One instrument in four (27%) was dedicated. The percentage of dedicated instruments by field is shown in Figure 21. Physical sciences (39%) and engineering (37%) had the largest proportions. Only 17 percent of the instruments in computer and biological sciences were dedicated instruments. (See Appendix Table 35). Physics/astronomy, with 48 percent, and chemical engineering, with 52 percent, were the subfields with the largest proportions of dedicated instruments. (See Appendix Table 35A.)

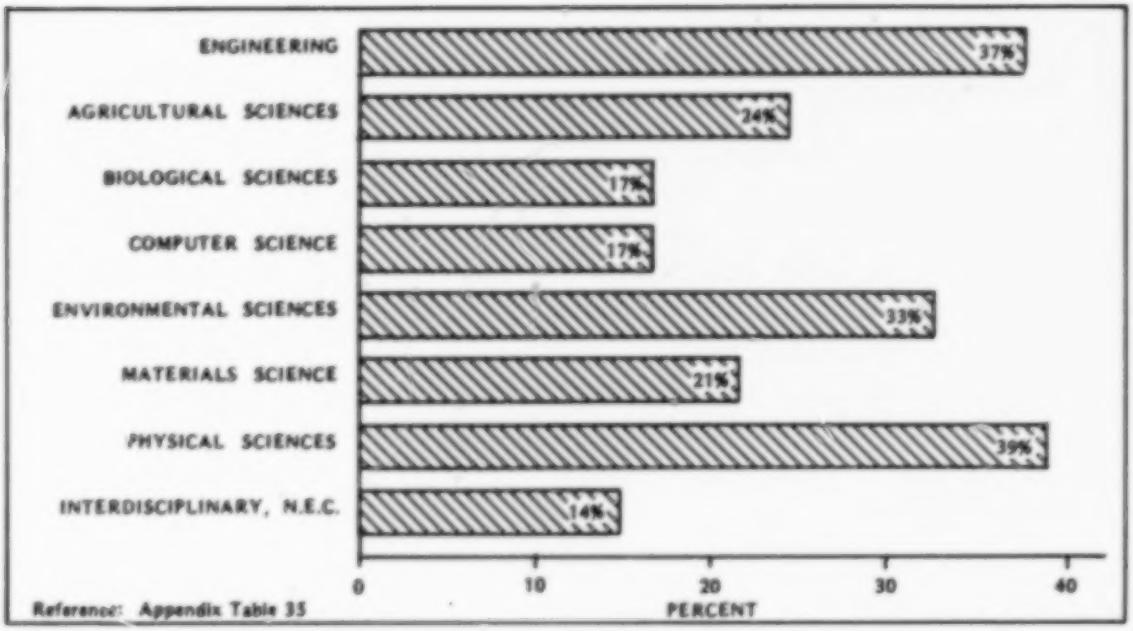

Figure 21. Percent of in-use systems dedicated for use in specific experiments and not available for general purpose use, by field

Number of Users

The mean number of users for all instruments was 14.3. For dedicated instruments the mean was 8.2; for general purpose instruments it was 16.5. Computer science had far more users per instrument than any other field (59.2). The mean for materials science was 34.4. Agricultural science, with a mean of 11.0, and biological sciences, with a mean of 11.5, had the smallest number of users per instrument. (See Appendix Table 36.)

Chemical engineering, with the highest proportion of dedicated instruments and the smallest proportion of shared-access instruments, was the subfield with the smallest number of users — 6.4 per instrument. Electrical engineering and chemistry were the two subfields with the largest mean number of users — 20.5 and 19.0 respectively. (See Appendix Table 36A.)

Several factors of interest to the study have been analyzed in terms of their relationships to numbers of users. The results are presented in Appendix Table 37. It was found that whether an instrument is state-of-the-art or not had little to do with its number of users. There was also little correlation between an instrument's working condition and number of users. On the other hand, purchase cost was strongly related: for instruments costing between $10,000 and $24,999, the mean number of users was 12.3, while for those between $75,000 and $1 million it was 27.2. This is illustrated in Figure 22.

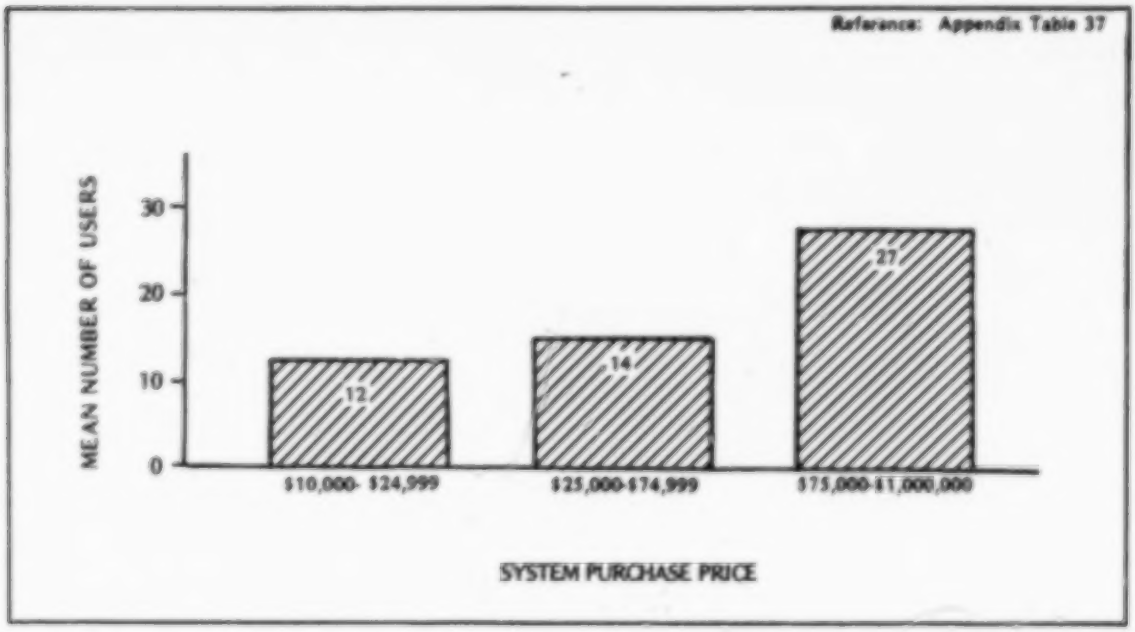

Figure 22. Mean annual number of users of in-use instrument systems, by purchase price

Age of the instrument was moderately related to number of users. Instruments from 1 to 5 years old averaged 15.8 users, and those over 10 years averaged 11.6 users.

Location of the instrument was, as would be expected, very strongly related to number of users. Those in shared-access facilities averaged 21.8 users, while those in the laboratories of individual investigators had an average of 8.9 users.

Origins of Equipment Users

Appendix Table 39 shows the proportions of instrument systems that were used by five categories of users. Nearly all instruments (92%) were used at some time by faculty of the same department, and a very large proportion (85%) by nonfaculty researchers from the same department. One-third of all instruments (34%) were used by researchers from other departments of the same institution. Investigators from other universities and nonacademic researchers each used 12 percent of the instrument systems.

Over half of the systems in computer science (54%) and materials science (57%) were used by research personnel from other departments of the same institution, and nearly half (46%) of instruments in agricultural sciences. Environmental sciences had the largest proportions of instruments used by researchers from outside the university: 31 percent by those from other universities, and 18 percent by nonacademic researchers.

Looking at other factors that might be related to use by particular classes of investigators, state-of-the-art instruments showed little difference from other instruments. System purchase price, however, showed a decided relationship with use by outside investigators: while 31 percent of the least costly instruments were used by investigators from outside the department but in the same institution, 49 percent of the most expensive were used by such investigators. Similar relationships were found for investigators from other universities and for nonacademic researchers. On the other hand, there was very little difference between the usage of "less costly" and "most costly" instruments by research personnel of the host department.

7. MAINTENANCE AND REPAIR

HIGHLIGHTS

- For every $1.00 spent purchasing research equipment in the survey years, an additional 25 cents was spent providing instrument maintenance and repair.
- An average (mean) of about $35,000 was spent per department or research facility for maintenance and repair in the survey years. However, materials science spent more than three times and computer science twice that amount, while agricultural sciences spent a little more than half.
- Only 11 percent of the departments considered their maintenance and repair facilities as "excellent," and about half reported either nonexistent facilities (13%) or insufficient facilities (36%).
- Computer science and the biological and agricultural sciences were predominately dependent on outside sources — service contracts or field services as needed — for maintenance and repair of their instruments, while all other fields were serviced mostly by on-campus personnel.
- The mean cost per instrument for maintenance and repair during the survey years was $1,500. For service contracts, the mean cost per instrument was $3,200, and for field service it was $1,400.
- The mean cost for maintenance and repair of an instrument originally purchased for between $75,000 and $1 million was almost 12 times that of servicing an instrument that was originally purchased for between $10,000 and $24,999.

DISCUSSION

The costs and quality of instrument maintenance and repair (M&R) are an integral part of assessing the status of academic research instrumentation. In addition to constituting a significant component of total instrumentation-related costs, institutions' M&R practices and provisions may have an important effect on the operating condition and longevity of instruments.

Assessment of M&R Facilities

Department/facility heads assessed the instrumentation support services available to their departments, including such facilities as electronics and machine shops. (See Appendix Table 40.)

Figure 23 illustrates these assessments by field. Overall, only 11 percent regarded their facilities as excellent; 39 percent regarded them as adequate, and 36 percent as insufficient. Materials science stood above all fields in assessing 50 percent of the M&R facilities as excellent; this field, however, is essentially outside the department structure of the universities, and is separately funded. The positive assessments for interdisciplinary reflect the nondepartmental nature of many of those laboratories.

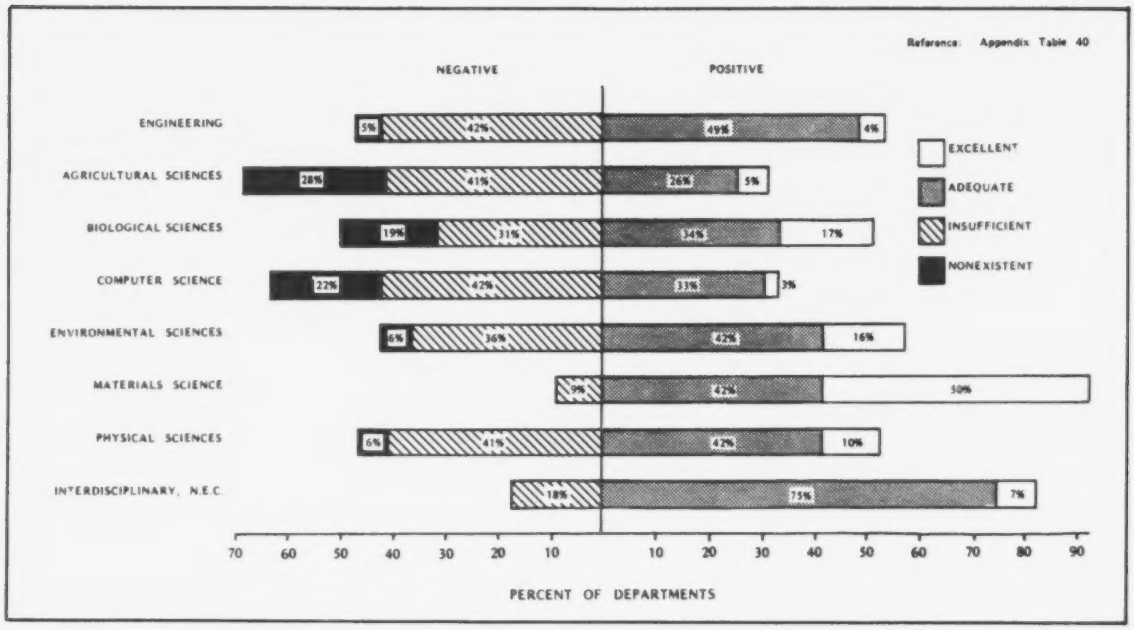

Figure 23. Assessment of the quality of maintenance and repair facilities, by field

No facilities at all were reported by 28 percent of departments in the agricultural sciences, 19 percent of those in the biological sciences, and 22 percent of the computer science departments. Despite the lack of facilities in biological sciences, nevertheless, several subfields seemed quite satisfied with their M&R services: molecular/cellular biology and physiology/biophysics each considered about one-third of their facilities as excellent, and an equal amount adequate, while anatomy and botany reported at least 60 percent as adequate or better. For food/nutrition, however, none were excellent and 54 percent insufficient. (See Appendix Table 40B.)

Insufficient facilities were reported by 61 percent of the metallurgical/materials engineering departments and half of those in electrical engineering and chemistry. On the positive side, physics/astronomy reported only 1 percent nonexistent and 69 percent at least adequate, and chemical and mechanical engineering had similar percentages for adequate or better, with none reporting nonexistent. (See Appendix Table 40A.)

Maintenance and Repair Expenditures

A total of $104,800,000 was spent on M&R of research equipment for all fields during the survey year. Thus, for every dollar spent to purchase research equipment in the survey year, an additional 25 cents was spent on M&R. (See Appendix Table 13.) An average (mean) of $35,300 per department was spent for M&R in that year. Agricultural sciences spent the least, $19,600 per department, followed by biological sciences and engineering, both of which spent somewhat below $30,000. High per department expenditures were found for materials science ($120,800), computer sciences ($70,300), and physical sciences ($69,000). (See Appendix Table 41.)

The lowest per department expenditures for M&R among the subfields were animal sciences ($8,300) and civil engineering ($12,000). Botany, food/nutrition, and microbiology/immunology all spent $16,000 or less. The subfields with the largest per department expenditures were physics ($71,000), chemistry ($66,300), and electrical engineering ($52,000). (See Appendix Tables 41A and 41B.)

Methods of Providing M&R Service

In general, M&R is performed either by within-university resources or by outside sources. Overall, departments spent about 40 percent of their total M&R expenditures on outside services, for a mean of $14,700 per department. A like amount was spent on university-based personnel for M&R. The remainder, about 20 percent of the total, went for M&R supplies, equipment, and facilities. (See Appendix Table 41.)

There was wide variation among the fields. The physical sciences, for example, spent 63 percent of their M&R funds for university-based personnel, while computer science spent 53 percent on external services. The agricultural and biological sciences spent two to three times as much on outside services as on university-based personnel, while engineering and materials science spent twice as much for university staff as for outside services.

The servicing of instrument systems is examined in Appendix Table 42. About one-third (34%) of all instrument systems were serviced on campus, split nearly equally between research personnel (i.e., faculty, graduate/medical students, and postdoctorates) and the university's M&R staff. Service contracts and field service (the latter performed only on request as needed) each took care of 24 percent of the instruments, while 18 percent did not require any M&R service during the survey year.

The same differences among fields that were found for the relative divisions of department expenditures between on-campus and outside servicing also appeared for the numbers of instruments serviced by those sources. (See Figure 24.) Computer science had more than half of its instruments under service contract, and another fourth received field service as needed. Agricultural and biological sciences also displayed trends in that direction, although not quite to the same degree. All the other fields relied more on campus-based services.

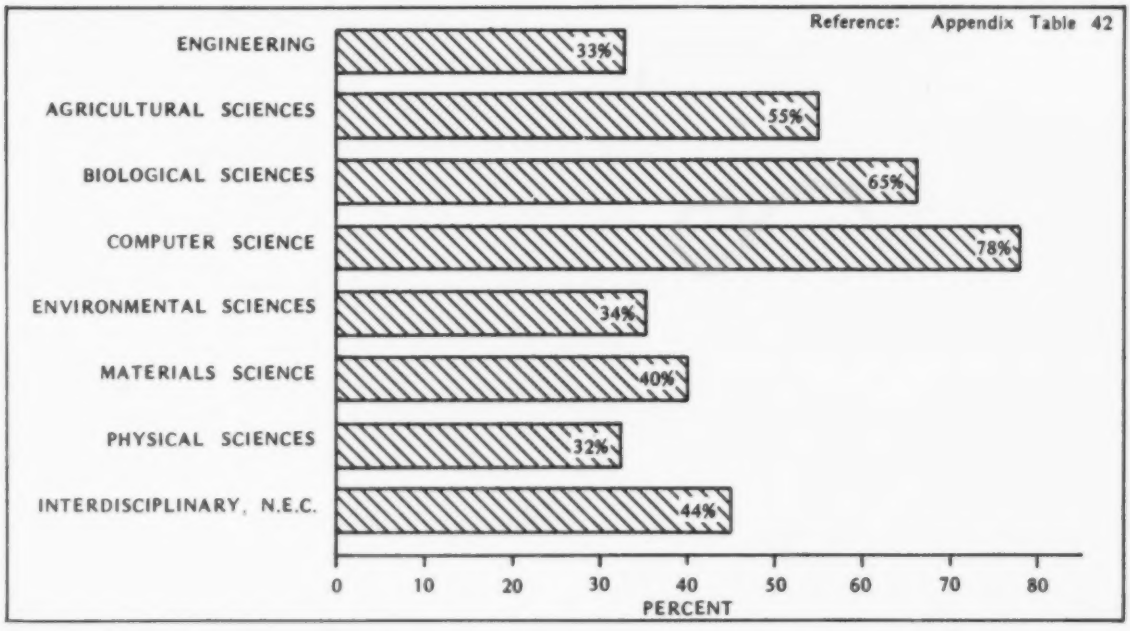

Figure 24. Principal means of servicing instruments: Percent receiving outside services

A moderate shift from the use of outside services to on-campus services occurred as instruments aged. Instrument systems from one to five years old were almost twice as likely to be serviced by outside sources as by university-based personnel. Those over 10 years old were slightly more likely to receive on-campus service. (See Appendix Table 42.)

M&R Costs per Instrument System

The mean cost of maintaining and repairing an instrument in the year of the survey was $1,500. Analyzing by means of servicing, the mean cost of service contracts was $3,200, that for field service was $1,400, for university M&R staff it was $1,300, and for research personnel the mean was $800. (See Appendix Table 43.)

Figure 25 illustrates the differences among fields. Computer science had the highest mean cost per system ($3,700), and agricultural sciences the lowest ($900).

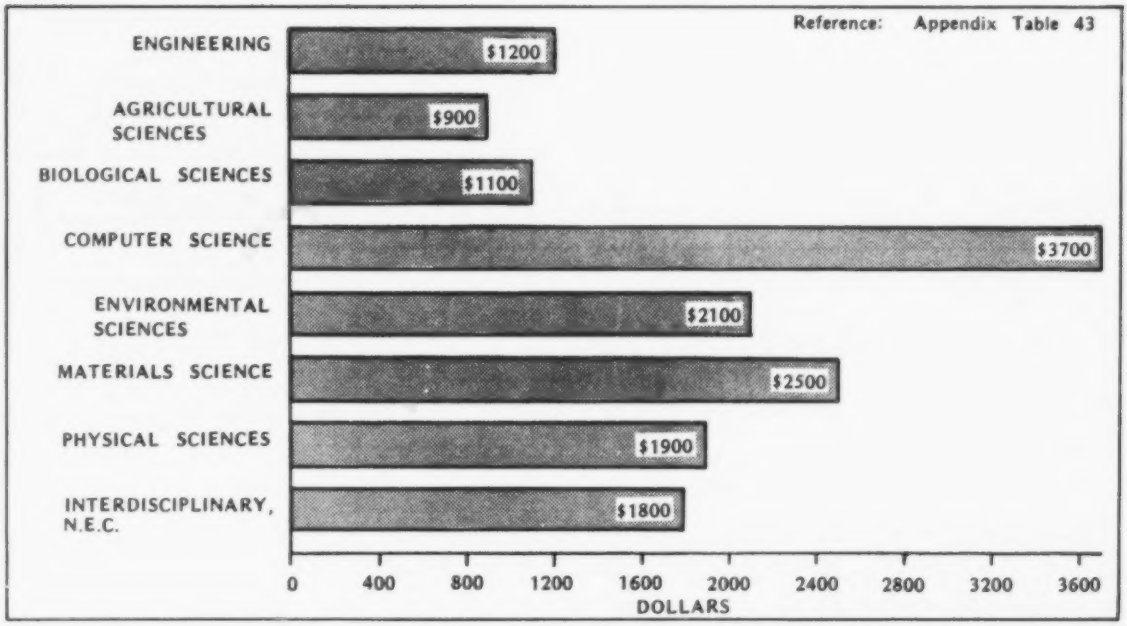

Figure 25. Mean annual expenditure per system for maintenance and repair

Appendix Table 43 also reveals substantial mean cost differences among fields within the four principal means of servicing equipment. For instruments under service contract, environmental sciences spent a mean of $7,100, and computer science spent $6,200, but agricultural sciences spent $1,700. University-based M&R staff received an average of $4,900 to service materials science equipment, a number that reflects the special funding of facilities in that field, since no other field approached that level.

Service contracts among the subfields were highest for physics/astronomy ($8,700) and mechanical engineering ($8,400), as is shown in Appendix Table 43A. Only small proportions of instruments in these subfields (7% and 11% respectively) were under service contract, however, and the large costs may reflect the special needs of a few expensive instruments. (See Appendix Table 42A.)

The cost of the instrument was highly related to the cost of M&R servicing. (See Appendix Table 44.) For the least costly the mean expenditure for M&R was $600. For the middle range it was $1,500, and for the most expensive the mean cost

was $7,100. This relationship held true for all four methods of servicing, with the difference for service contracts particularly large: the mean cost for instruments in the lowest cost range that were under service contract was $1,400, while the mean cost for those with the highest purchase cost was $11,200. Figure 26 presents these relationships for each of the means of servicing.

No relationship was found between age of instruments and their cost of M&R, no matter what the method of servicing.

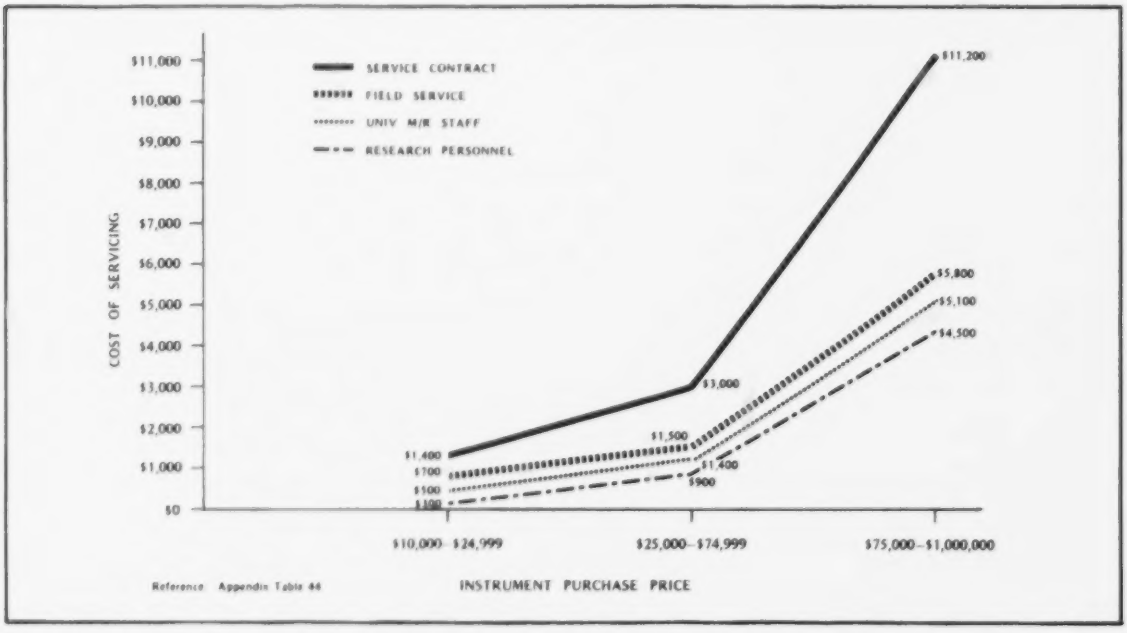

Figure 26. Mean annual expenditure per system for maintenance and repair, by purchase price and principal means of servicing

APPENDICES

APPENDIX A

Technical Notes

TECHNICAL NOTES

SAMPLE DESIGN AND ESTIMATION PROCEDURE

Phase I Fields and Institutions. Phase I encompassed the physical and computer sciences and engineering. In this phase, survey data were collected from a stratified probability sample of 43 institutions selected from the 157 largest academic research and development (R&D) performers in the nation, excluding medical schools and University-administered, Federally-funded R&D Centers (FFRDC's). Specifically, the "universe" to which the Phase I survey findings apply consists of the 157 nonmedical, nonmilitary U.S. colleges and universities that had $3 million or more in separately-budgeted science and engineering (S/E) R&D expenditures in any of the fiscal years FY 1977 to FY 1980.[1]

These 157 institutions collectively accounted for 95 percent of all nonmedical, non-FFRDC R&D expenditures reported to NSF for FY 1980 by all U.S. colleges and universities. Thus, although the Phase I survey represented only a small fraction of the nation's approximately 3,000 postsecondary institutions, it encompassed most institutions with significant capabilities for the kinds of advanced research that require instrumentation in the $10,000+ range.

In selecting the Phase I sample of 43 institutions, the probability of selection of each institution in the survey universe was approximately proportionate to its R&D size, as indicated by its FY 1980 nonmedical, science and engineering, R&D expenditures. Within R&D size classes, the proportion of private (or public) institutions in the sample was approximately the same as in the nation as a whole. The design is summarized in Table A-1.

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[1] Academic Science: R&D Funds, Fiscal Year 1980 (Detailed Statistical Tables). (NSF 82-300), 1982.

Table A-1. Phase I institution sample design

FY 1980 S/E R&D expenditures	No. institutions in nation			No. institutions in sample		
	Total	Private	Public	Total	Private	Public
Total, all institutions over $3 million	157	53	104	43	15	28
Large institutions, total	38	11	27	23	7	16
Over $90 million	3	2	1	3	2	1
$52.5-$89.9 million	15	3	12	10	2	8
$33-$52.4 million	20	6	14	10	3	7
Smaller institutions, total	119	42	77	20	8	12
$19-$32.9 million	30	11	19	10	4	6
$3-$18.9 million	89	31	58	10	4	6

Phase II Fields and Institutions. Phase II dealt with the agricultural, biological, and environmental sciences. Data were collected from the same institutions that participated in Phase I, and from a stratified probability sample of 24 medical schools selected from among the 92 medical schools with at least $3 million in total NIH extramural awards in 1982.[2] These 92 medical schools accounted for 97 percent of all FY 1982 NIH awards to U.S. medical schools.

For the medical school sample, six schools were selected from each of four strata, as shown in Table A-2. The selection procedure was one that maximized overlap with the original NSF institution sample. The probability of selection for each institution in the survey universe was approximately proportional to its FY 1982 NIH award size.

[2] Summary of NIH FY 1982 Extramural Awards to Medical Schools. Internal document, National Institutes of Health.

Table A-2. Medical school sample design

FY 1982 NIH extra-mural awards	No. institutions in nation			No. institutions in sample		
	Total	Private	Public	Total	Private	Public
Total, all institutions over $3 million	92	40	52	24	10	14
Large institutions, total	20	13	7	12	6	6
Over $43.6 million	8	6	2	6	4	2
$25.0-$42.2 million	12	7	5	6	2	4
Smaller institutions, total	72	27	45	12	4	8
$13.5-$24.7 million	18	9	9	6	3	3
$3.1-$13.4 million	54	18	36	6	1	5

Departments and Facilities. At each sampled university, all institutionally-operated departments and nondepartmental research/instrumentation facilities in the surveyed fields that contained any research instrument systems in the $10,000 to $1,000,000 cost range were identified and asked to participate in the survey. Excepted from this sample were: (1) general purpose university or medical school computer centers, and (b) other nondepartmental instrumentation facilities that, in effect, consisted of a single system costing over $1,000,000 (research reactors or cyclotrons, observatories, etc.). A total of 971 "in-scope" departments and facilities was identified, each of which was asked to complete a Department/Facility Questionnaire inquiring about the department's (or facility's) instrumentation-related needs, priorities, expenditures and sources of funding support (see Appendix E).

The 67 sampled institutions contained 66 other instrumentation facilities that were excluded because they were beyond the scope of this survey. Of these, 44 were general purpose university computer centers. Most of the rest (19 of 22) were multi-million dollar instrument systems in high energy physics or astronomy.

Research Instruments. The survey sought to represent all instrument systems at "in-scope" departments and facilities that: (a) were used or intended primarily for research, and (b) originally cost $10,000 to $1,000,000, including the cost of any separately-purchased, dedicated accessories or components. Briefly, the sequence of steps at each department and facility was as follows.

First, a preliminary listing of all $10,000+ items of research equipment was obtained, usually from the university's computerized central property inventory system. Often, the preliminary lists were overly inclusive, containing in addition to items of research equipment, miscellaneous property such as furniture, physical plant equipment (e.g., exhaust hoods, heating and air conditioning units), office equipment (e.g., word processors), vehicles, and the like.

Second, after screening out unquestionably inappropriate entries, the contractor selected a random probability sample of $10,000 to $1,000,000 items in each department and facility. The instrument sample design took account of the number and cost of instruments listed in a department or facility. To ensure adequate sample size for analysis without overburdening large departments and facilities, a variable sampling rate was used.

In Phase I, if the number of items costing $50,000+ was 12 or less, all were included; otherwise, all items costing $100,000+ were included and a simple random sample of 1 in 3 items in the $50,000 to $99,999 range was selected. For items in the $10,000 to $49,999 range, sampling rates ranged from 100 percent for departments/facilities with 1 to 9 such items down to 12.5 percent (1/8) for departments/facilities with over 100 items in this cost range.

From the 410 eligible Phase I departments and facilities in the 43 sampled institutions, a total of 12,686 equipment items were identified in preliminary listings; of these, 4,648 were selected to be in the survey sample. Overall, the Phase I equipment sample included 683 items costing $100,000 to $1,000,000 (100% of the listed items in this cost range), 833 of 1,087 items costing $50,000 to $99,999 (77%), and 3,132 of 10,916 items in the $10,000 to $49,999 range (29%).

In Phase II, all items costing $50,000 or more were included in the survey. For items in the $10,000 to $49,999 range, sampling rates varied from 100 percent for departments/facilities with fewer than 12 such instruments down to a simple random sample of 14.3 percent (1/7) for departments with 97 or more items. This procedure resulted in the selection of 5,823 equipment items out of a total of 9,793 that were eligible for inclusion in all departments. There were 779 items in the sample that cost between $50,000 and $1 million. Of those costing between $10,000 and $49,999, 56 percent (5,044 out of 9,014) were included in the sample.

The final step was that, for each sampled instrument, department/facility administrators were asked to arrange for a brief Instrument Data Sheet to be filled in by the responsible principal investigator or other person knowledgeable about the instrument's status, cost, and condition (see Appendix F).

Estimation Procedures. All results in this report are in the form of national estimates statistically weighted to represent all research departments and non-departmental research facilities in the fields surveyed at the 157 largest nonmedical R&D universities and the 92 largest R&D medical schools in the nation.

The estimation weights applied to Department/Facility Questionnaire data were comparatively simple. Since all applicable departments and facilities in each sampled university were asked to participate in the survey and since nearly all of them actually did provide usable questionnaire responses, the estimation weight for each responding department was simply the inverse of the selection probability of the university in which the department or facility was located, multiplied by a small nonresponse adjustment factor.[3]

[3]There was one exception to this general rule. At one university, a stratified probability sample of biological science research laboratories was selected. For those facilities, the estimation weight was the inverse of the university's probability of selection, multipled by the inverse of the facility's probability of selection.

Estimation weights for the survey of $10,000 to $1,000,000 instruments were somewhat more complex. The weight for a completed instrument questionnaire was the product of:

- The university sampling weight — the inverse of the university's probability of selection;
- The facility sampling weight (at one university only) — the inverse of the facility's probability of selection;
- The instrument sampling weight — the inverse of the probability of selection of the particular instrument from the department or facility equipment list;
- An adjustment to the initial instrument sampling weight in situations where the instrument was part of a larger system with two or more separately-listed components in the $10,000 to $1,000,000 range (in which case, the system selection probability was larger than the selection probability for any one component); and
- A nonresponse adjustment, where needed.

Information about the statistical accuracy of national estimates derived from the study samples of departments and instruments is presented in Appendix G.

SURVEY ADMINISTRATION AND RESPONSE

Survey Administration. At each institution, all data collection arrangements were handled by a survey coordinator appointed by the office of the president of the university or dean of the medical school. Typically, coordinators were themselves senior administrators, such as Dean of the Graduate School or Vice President for Research. These individuals were responsible for: identifying all relevant departments and facilities; obtaining needed preliminary lists of equipment; and after equipment samples had been selected by the survey contractor, arranging for the distribution, completion, and return of survey questionnaires.

Survey Response. In a complex, multistage survey such as this, there are several levels or types of response to consider. At the institution level, the response rate was 100 percent. The university administration at all 43 sampled Phase I institutions promptly agreed to participate in the survey and appointed a coordinator. In every case, the coordinator arranged for the preparation and delivery of preliminary equipment listings for all applicable departments and facilities, and subsequently, arranged for the delivery and return of survey materials to and from these departments/facilities. One Phase I institution (a small engineering school) contained no departments or facilities in Phase II fields. All of the remaining 42 Phase I institutions continued to participate fully throughout Phase II, as did all 24 sampled medical schools.

Completed Department/Facility Questionnaires were received from the heads of 912 of the 971 eligible departments and facilities (94%). Even more impressive, faculty researchers returned completed Instrument Data Sheets for 10,139 of the 10,471 instruments in the equipment sample (97%). Of the remaining 332 equipment items, only 100 involved refusals — less than one percent of the original sample. The rest of the nonresponse was due almost entirely to the absence of knowledgeable respondents during the survey period. As would be expected with overall response rates this high, no significant differences in department/facility or in equipment response rates were found by phase of data collection, by type of institution, by field of research, or by instrument cost range.

Of the 10,139 completed Instrument Data Sheets, 8,704 described research instrument systems that were within the scope of this study and were included in the statistical analysis. The remaining 1,435 forms were classified as out-of-scope for one reason or another, e.g., the item was no longer present (sold, cannibalized, etc.); it was used primarily for nonresearch purposes; it was an accessory or component in a system already described on another form; etc.

Most analysis variables, whether obtained from the Department Questionnaire or from the Instrument Data Sheet, had no more than one or two percent nonresponse. Because item nonresponse was inconsequential, most tabulations in this

report simply exclude cases with missing values on any of the table's variables. This procedure has no effect on estimates of percentages, means, or other ratios. For estimates of totals (e.g., estimated total number of instruments in the national stock or estimated total cost of this equipment), the effect is to lower estimates slightly and to create slight differences when two or more tables present estimates of the same total. The reader is alerted to expect slight discrepancies of this kind when comparing findings from one table to another.

DEFINITIONS

The following definitions and guidelines are provided to aid in the effective use of the data in this report.

Survey Year. The survey year for research equipment in Phase I departments/facilities was the 1982 calendar year. For Phase II, the survey year was 1983. In both phases, data collection occurred shortly after the end of the applicable survey year.

Field of Science/Engineering. In Phase I, data were collected from academic departments and research facilities in the physical, computer and materials sciences, engineering, and interdisciplinary combinations of these fields. Phase II of the survey involved collection of data for the agricultural, biological and environmental sciences.

Table A-3 summarizes the field and subfield typology used in this report and shows the number of in-scope Department/Facility Questionnaires and Instrument Data Sheets obtained in each category. In this table and in all other tables throughout this report, instruments actually used for research during the survey year were classified based on user descriptions of the instrument's principal field of research use during the year. Departments, research facilities, and instruments not in active research use were classified to indicate the principal field and subfield of research in the department or facility as a whole.

Table A-3. Number of in-scope department questionnaires and instrument data forms obtained in the survey, by field and subfield

Department Questionnaires	Instrument Data Forms	Field and Subfield
912	8704	Total, all fields surveyed
220	1652	Engineering
30	188	Chemical
32	179	Civil (architectural)
32	338	Electrical (electronic, computer engineering)
31	271	Mechanical
25	234	Metallurgical/Materials (ceramic, mining, mineral, petroleum)
70	442	Other, n.e.c. (e.g., aerospace, agricultural, biomedical, industrial, nuclear, systems, multiple or unspecified subfields)
107	686	Agricultural Sciences
50	408	Agronomic sciences (e.g., agronomy, horticulture, pomology, plant pathology, soil management)
33	181	Animal sciences (e.g., dairy sciences, poultry sciences, animal nutrition, range sciences)
24	97	Natural resources management (forestry, pulp and paper production, fisheries and wildlife management, agricultural chemistry)
347	3577	Biological Sciences (in graduate schools and medical schools)
23	132	Anatomy
41	711	Biochemistry
18	145	Botany
22	146	Food and nutrition
41	340	Microbiology/immunology (bacteriology, virology)
25	566	Molecular/cellular biology and genetics (embryology, developmental biology)
27	204	Pathology [except laboratory medicine, clinical pathology or clinical chemistry]
27	302	Pharmacology/toxicology [except clinical]
34	493	Physiology/biophysics
29	167	Zoology, general and n.e.c. (e.g., entomology, neurobiology)
60	371	Biology, general and n.e.c. (e.g., cancer research center)
26	208	Computer Science (no subdivisions)
77	708	Environmental Sciences (geological, atmospheric and oceanographic sciences)
9	120	Materials Science (interdisciplinary, not just materials engineering)
102	1580	Physical Sciences
46	775	Chemistry (physical, inorganic, organic, polymer; not biochemistry)
56	805	Physics and astronomy
24	173	Interdisciplinary, n.e.c. (e.g., interdisciplinary nuclear science research facility, textile sciences department)

Research Equipment. In the Department/Facility Questionnaire, research equipment was defined as: "any item (or interrelated collection of items comprising a system) of nonexpendable tangible property or software having a useful life of more than two years and an acquisition cost of $500 or more, which is used wholly or in part for research" (see Appendix E, question 6). The equipment survey used a narrower definition; it was limited to instrument systems with an original purchase price of $10,000 - $1,000,000.

System. In data collection terms, an instrument system consisted of an instrument or component sampled from a department/facility property list, plus any separately acquired "add-ons" or components that, as of December 31 of the survey year, were dedicated solely for use with the sampled item. The instrument system was the basic counting unit in the equipment survey, and all reported cost figures reflect costs for the full system -- the base unit plus all dedicated accessories.

National Stock. In this report, the term "national stock" of academic research equipment refers to all instrument systems costing $10,000 to $1,000,000 that, as of December 31 of the survey year, were physically located at an academic institution in the survey universe and were principally used (or intended for use) in original scientific research in one or more of the fields encompassed by the survey. In addition to systems actually used for research in the survey year, this includes existing components of nonoperational systems still under construction at the end of the year and research systems that were physically present but inoperative or inactive throughout the year.

Purchase Price. The purchase price refers to the manufacturer's list price at the time of original purchase (i.e., when new). For multi-component systems, the purchase price is the aggregate list price of all components and accessories. Except where clearly specified otherwise, all cost/value/investment statistics in this report refer to system purchase price.

Acquisition Cost. Acquisition cost is the actual cost to acquire the instrument system at the current host university, including transportation and construction/labor costs. For used, discounted or rebated equipment, it is the price actually paid to the seller, plus transportation and installation costs; for donated, loaned, transferred, or surplus equipment, it represents only the transportation and installation costs, if any.

Replacement Value. This value is the user estimate of the current purchase price of the same or functionally equivalent equipment, as of the time of the survey.

1982 Constant-Dollar Cost. This is the original purchase price converted to constant 1982 dollars using the Machinery and Equipment Index of the Bureau of Labor Statistics' annual Producer Price Index to adjust for inflation. Arithmetically, the value is calculated by multiplying the original purchase price by the ratio of the 1982 annual PPI index for Machinery and Equipment to the same PPI index for the year in which the instrument system was originally purchased or constructed.

APPENDIX B

Detailed Statistical Tables

NEEDS AND PRIORITIES

Table		Page
1.	Number of departments and facilities and percent reporting important subject areas in which critical experiments cannot be performed due to lack of needed equipment, by field	B-13
1A.	Number of departments and facilities and percent reporting important subject areas in which critical experiments cannot be performed due to lack of needed equipment, by physical sciences and engineering subfield	B-14
1B.	Number of departments and facilities and percent reporting important subject areas in which critical experiments cannot be performed due to lack of needed equipment, by agricultural and biological sciences subfield	B-15
2.	Department/facility assessment of adequacy of available research instrumentation, by field	B-16
2A.	Department/facility assessment of adequacy of available research instrumentation, by physical sciences and engineering subfield	B-17
2B.	Department/facility assessment of adequacy of available research instrumentation, by agricultural and biological sciences subfield	B-18
3.	Department/facility recommendations for increased Federal support for research instrumentation, by field	B-19
3A.	Department/facility recommendations for increased Federal support for research instrumentation, by physical sciences and engineering subfield	B-20
3B.	Department/facility recommendations for increased Federal support for research instrumentation, by agricultural and biological sciences subfield	B-21

THE NATIONAL STOCK

4.	Total amount of academic research instrumentation in national stock and mean price per system, by field	B-22
4A.	Total amount of academic research instrumentation in national stock and mean price per system, by physical sciences and engineering subfield	B-23

THE NATIONAL STOCK (continued)

Table		Page
4B.	Total amount of academic research instrumentation in national stock and mean price per system, by agricultural and biological sciences subfield	B-24
5.	Indices of equipment-extensiveness of selected fields and subfields of academic research	B-25
6.	Mean amount of academic research equipment per institution, by university control and by field	B-26
6A.	Mean amount of academic research equipment per institution, by university control and by physical sciences and engineering subfield	B-27
6B.	Mean amount of academic research equipment per institution, by university control and by agricultural and biological sciences subfield	B-28
7.	Distribution of academic research instrument systems in national stock, by system purchase price and by field	B-29
7A.	Distribution of academic research instrument systems in national stock, by system purchase price and by physical sciences and engineering subfield	B-30
7B.	Distribution of academic research instrument systems in national stock, by system purchase price and by agricultural and biological sciences subfield	B-31
8.	Distribution of aggregate price of academic research instrument systems in national stock, by system purchase price and by field	B-32
8A.	Distribution of aggregate price of academic research instrument systems in national stock, by system purchase price and by physical sciences and engineering subfield	B-33
8B.	Distribution of aggregate price of academic research instrument systems in national stock, by system purchase price and by agricultural and biological sciences subfield	B-34
9.	Research status of academic research instrument systems in national stock, by field	B-35
9A.	Research status of academic research instrument systems in national stock, by physical sciences and engineering subfield	B-36

THE NATIONAL STOCK (continued)

Table		Page
9B.	Research status of academic research instrument systems in national stock, by agricultural and biological sciences subfield	B-37
10.	Aggregate purchase price of academic research instrument systems in national stock, by system research status and by field	B-38
10A.	Aggregate purchase price of academic research instrument systems in national stock, by system research status and by physical sciences and engineering subfield	B-39
10B.	Aggregate purchase price of academic research instrument systems in national stock, by system research status and by agricultural and biological sciences subfield	B-40
11.	Number and aggregate cost/value of academic research instrument systems in active research use, by field	B-41
11A.	Number and aggregate cost/value of academic research instrument systems in active research use, by physical sciences and engineering subfield	B-42
11B.	Number and aggregate cost/value of academic research instrument systems in active research use, by agricultural and biological sciences subfield	B-43

ANNUAL EXPENDITURES

12.	Mean amount of in-use academic research equipment per institution, by university control and by field	B-44
12A.	Mean amount of in-use academic research equipment per institution, by university control and by physical sciences and engineering subfield	B-45
12B.	Mean amount of in-use academic research equipment per institution, by university control and by agricultural and biological sciences subfield	B-46
13.	Instrumentation-related expenditures in academic departments and facilities, by field	B-47
13A.	Instrumentation-related expenditures in academic departments and facilities, by physical sciences and engineering subfield	B-48

ANNUAL EXPENDITURES (continued)

Table		Page
13B.	Instrumentation-related expenditures in academic departments and facilities, by agricultural and biological sciences subfield	B-49
14.	Department/facility expenditures for purchase of nonexpendable academic research equipment in current and next fiscal year, by field	B-50
14A.	Department/facility expenditures for purchase of nonexpendable academic research equipment in current and next fiscal year, by physical sciences and engineering subfield	B-51
14B.	Department/facility expenditures for purchase of nonexpendable academic research equipment in current and next fiscal year, by agricultural and biological sciences subfield	B-52
15.	Mean annual expenditures for purchase of research equipment, by unit and by field	B-53
15A.	Mean annual expenditures for purchase of research equipment, by unit and by physical sciences and engineering subfield	B-54
15B.	Mean annual expenditures for purchase of research equipment, by unit and by agricultural and biological sciences subfield	B-55

RESEARCH STATUS, AGE, AND CONDITION

16.	Age of academic research instrument systems in national stock, by field	B-56
16A.	Age of academic research instrument systems in national stock, by physical sciences and engineering subfield	B-57
16B.	Age of academic research instrument systems in national stock, by agricultural and biological sciences subfield	B-58
17.	Percent of academic research instrument systems that are classified as state-of-the-art, by purchase price and by field	B-59

RESEARCH STATUS, AGE, AND CONDITION (continued)

Table		Page
17A.	Percent of academic research instrument systems that are classified as state-of-the-art, by purchase price and by physical sciences and engineering subfield	B-60
17B.	Percent of academic research instrument systems that are classified as state-of-the-art, by purchase price and by agricultural and biological sciences subfield	B-61
18.	Percent of academic research instrument systems in national stock classified as state-of-the-art, by age and by field	B-62
18A.	Percent of academic research instrument systems in national stock classified as state-of-the-art, by age and by physical sciences and engineering subfield	B-63
18B.	Percent of academic research instrument systems in national stock classified as state-of-the-art, by age and by agricultural and biological sciences subfield	B-64
19.	Age of academic instrument systems in research use, by field	B-65
19A.	Age of academic instrument systems in research use, by physical sciences and engineering subfield	B-66
19B.	Age of academic instrument systems in research use, by agricultural and biological sciences subfield	B-67
20.	Age of state-of-the-art academic research instrument systems, by field	B-68
20A.	Age of state-of-the-art academic research instrument systems, by physical sciences and engineering subfield	B-69
20B.	Age of state-of-the-art academic research instrument systems, by agricultural and biological sciences subfield	B-70
21.	Median age of academic research instrument systems, by research status and by field	B-71
21A.	Median age of academic research instrument systems, by research status and by physical sciences and engineering subfield	B-72
21B.	Median age of academic research instrument systems, by research status and by agricultural and biological sciences subfield	B-73

RESEARCH STATUS, AGE, AND CONDITION (continued)

Table		Page
22.	Condition of academic research instrument systems in use, by system age	B-74
23.	Percent of in-use research instrument systems in excellent working condition, by system research status and by field	B-75
23A.	Percent of in-use research instrument systems in excellent working condition, by system research status and by physical sciences and engineering subfield	B-76
23B.	Percent of in-use research instrument systems in excellent working condition, by system research status and by agricultural and biological sciences subfield	B-77
24.	Percent of in-use academic research instrument systems that are the "most advanced instrument of its kind accessible to its research users," by research status and by field	B-78
24A.	Percent of in-use academic research instrument systems that are the "most advanced instrument of its kind accessible to its research users," by research status and by physical sciences and engineering subfield	B-79
24B.	Percent of in-use academic research instrument systems that are the "most advanced instrument of its kind accessible to its research users," by research status and by agricultural and biological sciences subfield	B-80

FUNDING SOURCES

25.	Means of acquisition of in-use academic research instrument systems, by field	B-81
25A.	Means of acquisition of in-use academic research instrument systems, by physical sciences and engineering subfield	B-82
25B.	Means of acquisition of in-use academic research instrument systems, by agricultural and biological sciences subfield	B-83
26.	Sources of funds for acquisition of in-use academic research equipment, by field	B-84

FUNDING SOURCES (continued)

Table		Page
26A.	Sources of funds for acquisition of in-use academic research equipment, by physical sciences and engineering subfield	B-85
26B.	Sources of funds for acquisition of in-use academic research equipment, by agricultural and biological sciences subfield	B-86
27.	Fields receiving funding support for acquisition of in-use research equipment, by source of funds	B-87
28.	Acquisition cost of in-use academic research equipment, by source of funds and by control of institution and system purchase price	B-88
29.	Federal involvement in funding of in-use academic research instrument systems, by field	B-89
29A.	Federal involvement in funding of in-use academic research instrument systems, by physical sciences and engineering subfield	B-90
29B.	Federal involvement in funding of in-use academic research instrument systems, by agricultural and biological sciences subfield	B-91
30.	Recent Federal involvement in funding of in-use academic research instrument systems, by year and by field	B-92

LOCATION AND USAGE

31.	Location of in-use academic research instrument systems, by field	B-93
31A.	Location of in-use academic research instrument systems, by physical sciences and engineering subfield	B-94
31B.	Location of in-use academic research instrument systems, by agricultural and biological sciences subfield	B-95
32.	Percent of in-use academic research instrument systems located in shared-access facilities, by research status and by field	B-96

LOCATION AND USAGE (continued)

Table		Page
32A.	Percent of in-use academic research instrument systems located in shared-access facilities, by research status and by physical sciences and engineering subfield	B-97
32B.	Percent of in-use academic research instrument systems located in shared-access facilities, by research status and by agricultural and biological sciences subfield	B-98
33.	Percent of in-use academic research instrument systems located in shared-access facilities, by system purchase price and by field	B-99
33A.	Percent of in-use academic research instrument systems located in shared-access facilities, by system purchase price and by physical sciences and engineering subfield	B-100
33B.	Percent of in-use academic research instrument systems located in shared-access facilities, by system purchase price and by agricultural and biological sciences subfield	B-101
34.	Percent of in-use academic research instrument systems located in shared-access facilities, by system age and by field	B-102
34A.	Percent of in-use academic research instrument systems located in shared-access facilities, by system age and by physical sciences and engineering subfield	B-103
34B.	Percent of in-use academic research instrument systems located in shared-access facilities, by system age and by agricultural and biological sciences subfield	B-104
35.	Experimental role of in-use academic research instrument systems, by field	B-105
35A.	Experimental role of in-use academic research instrument systems, by physical sciences and engineering subfield	B-106
35B.	Experimental role of in-use academic research instrument systems, by agricultural and biological sciences subfield	B-107
36.	Mean number of research users of in-use academic research instrument systems, by experimental role and by field	B-108
36A.	Mean number of research users of in-use academic research instrument systems, by experimental role and by physical sciences and engineering subfield	B-109

LOCATION AND USAGE (continued)

Table		Page
36B.	Mean number of research users of in-use academic research instrument systems, by experimental role and by agricultural and biological sciences subfield	B-110
37.	Mean number of research users of in-use academic research instrument systems, by experimental role and by other system characteristics	B-111
38.	Types of research users of in-use academic research instrument systems, by research status and by system purchase price	B-112
39.	Types of research users of in-use academic research instrument systems, by field	B-113
39A.	Types of research users of in-use academic research instrument systems, by physical sciences and engineering subfield	B-114
39B.	Types of research users of in-use academic research instrument systems, by agricultural and biological sciences subfield	B-115

MAINTENANCE AND REPAIR

40.	Department/facility assessment of available instrumentation support services, by field	B-116
40A.	Department/facility assessment of available instrumentation support services, by physical sciences and engineering subfield	B-117
40B.	Department/facility assessment of available instrumentation support services, by agricultural and biological sciences subfield	B-118
41.	Annual expenditures per department/facility for maintenance and repair of research equipment by type of expenditure and by field	B-119
41A.	Annual expenditures per department/facility for maintenance and repair of research equipment, by type of expenditures and by physical sciences and engineering subfield	B-120

MAINTENANCE AND REPAIR (continued)

Table		Page
41B.	Annual expenditures per department/facility for maintenance and repair of research equipment, by type of expenditure and by agricultural and biological sciences subfield	B-121
42.	Principal means of servicing in-use academic research instruments, by field and age	B-122
42A.	Principal means of servicing in-use academic research instruments, by physical sciences and engineering subfield	B-123
42B.	Principal means of servicing in-use academic research instruments, by agricultural and biological sciences subfield	B-124
43.	Mean annual expenditures per system for maintenance and repair of in-use academic research instruments systems, by principal means of servicing and by field	B-125
43A.	Mean annual expenditures per system for maintenance and repair of in-use academic research instruments systems, by principal means of servicing and by physical sciences and engineering subfield	B-126
43B.	Mean annual expenditures per system for maintenance and repair of in-use academic research instruments systems, by principal means of servicing and by agricultural and biological sciences subfield	B-127
44.	Mean annual expenditures per system for maintenance and repair of in-use academic research instruments systems, by principal means of servicing and by purchase price and age	B-128

TABLE 1. NUMBER OF DEPARTMENTS AND FACILITIES AND PERCENT REPORTING IMPORTANT SUBJECT AREAS IN WHICH CRITICAL EXPERIMENTS CANNOT BE PERFORMED DUE TO LACK OF NEEDED EQUIPMENT, BY FIELD (1)

	NUMBER OF DEPARTMENTS/FACILITIES	PERCENT REPORTING INABILITY TO CONDUCT CRITICAL EXPERIMENTS DUE TO LACK OF NEEDED EQUIPMENT
TOTAL, SELECTED FIELDS	2902	72%
FIELD OF RESEARCH		
ENGINEERING	661	89%
AGRICULTURAL SCIENCES	254	79%
BIOLOGICAL SCIENCES, TOTAL	1197	56%
GRADUATE SCHOOLS	586	56%
MEDICAL SCHOOLS	611	56%
COMPUTER SCIENCE	91	93%
ENVIRONMENTAL SCIENCES	239	62%
MATERIALS SCIENCE	19	100%
PHYSICAL SCIENCES	375	87%
INTERDISCIPLINARY, N.E.C.	67	74%

(1) ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. FOR PHASE II FIELDS (AGRICULTURAL, BIOLOGICAL AND ENVIRONMENTAL SCIENCES), ESTIMATES ARE AS OF DECEMBER 1983. FOR ALL OTHER FIELDS, ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 912 DEPARTMENTS AND FACILITIES.

NOTE: SUBCATEGORY NUMBERS AND PERCENTAGES MAY NOT SUM EXACTLY TO TOTAL BECAUSE OF ROUNDING.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 1A. NUMBER OF DEPARTMENTS AND FACILITIES AND PERCENT REPORTING IMPORTANT SUBJECT AREAS IN WHICH CRITICAL EXPERIMENTS CANNOT BE PERFORMED DUE TO LACK OF NEEDED EQUIPMENT, BY PHYSICAL SCIENCES AND ENGINEERING SUBFIELD [1]

	NUMBER OF DEPARTMENTS/FACILITIES	PERCENT REPORTING INABILITY TO CONDUCT CRITICAL EXPERIMENTS DUE TO LACK OF NEEDED EQUIPMENT
PHYSICAL SCIENCES AND ENGINEERING		
PHYSICAL SCIENCES, TOTAL	375	87%
CHEMISTRY	176	93%
PHYSICS AND ASTRONOMY	199	82%
ENGINEERING, TOTAL	661	89%
CHEMICAL	97	92%
CIVIL	125	90%
ELECTRICAL	87	96%
MECHANICAL	87	92%
METALLURGICAL/MATERIALS	61	91%
OTHER, N.E.C.	204	83%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES IN THE NATION. ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 322 DEPARTMENTS AND FACILITIES.

NOTE: SUBCATEGORY NUMBERS AND PERCENTAGES MAY NOT SUM EXACTLY TO TOTAL BECAUSE OF ROUNDING.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 1B. NUMBER OF DEPARTMENTS AND FACILITIES AND PERCENT REPORTING IMPORTANT SUBJECT AREAS IN WHICH CRITICAL EXPERIMENTS CANNOT BE PERFORMED DUE TO LACK OF NEEDED EQUIPMENT, BY AGRICULTURAL AND BIOLOGICAL SCIENCES SUBFIELD [1]

	NUMBER OF DEPARTMENTS/FACILITIES	PERCENT REPORTING INABILITY TO CONDUCT CRITICAL EXPERIMENTS DUE TO LACK OF NEEDED EQUIPMENT
AGRICULTURAL AND BIOLOGICAL SCIENCES		
AGRICULTURAL SCIENCES, TOTAL	254	79%
AGRONOMIC SCIENCES	111	82%
ANIMAL SCIENCES	86	69%
NATURAL RESOURCE MGMT	57	88%
BIOLOGICAL SCIENCES, TOTAL	1197	56%
ANATOMY	86	57%
BIOCHEMISTRY	147	41%
BOTANY	49	51%
FOOD AND NUTRITION	53	85%
MICROBIOLOGY/IMMUNOLOGY	162	46%
MOLECULAR/CELLULAR BIOLOGY AND GENETICS	76	27%
PATHOLOGY	88	62%
PHARMACOLOGY/TOXICOLOGY	107	58%
PHYSIOLOGY/BIOPHYSICS	134	55%
ZOOLOGY/ENTOMOLOGY	69	69%
BIOLOGY, GENERAL AND N.E.C.	227	70%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. FOR ALL OTHER FIELDS, ESTIMATES ARE AS OF DECEMBER 1983. SAMPLE IS 454 DEPARTMENTS AND FACILITIES.

NOTE: SUBCATEGORY NUMBERS AND PERCENTAGES MAY NOT SUM EXACTLY TO TOTAL BECAUSE OF ROUNDING.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 2. DEPARTMENT/FACILITY ASSESSMENT OF ADEQUACY OF AVAILABLE RESEARCH INSTRUMENTATION, BY FIELD [1]

	PERCENT OF DEPARTMENTS/FACILITIES ASSESSING INSTRUMENTATION AVAILABLE TO TENURED FACULTY AND EQUIVALENT P.I.'s AS:				PERCENT OF DEPARTMENTS/FACILITIES ASSESSING INSTRUMENTATION AVAILABLE TO UNTENURED FACULTY AND EQUIVALENT P.I.'s AS:			
	TOTAL	EXCELLENT	ADEQUATE	INSUFFICIENT	TOTAL	EXCELLENT	ADEQUATE	INSUFFICIENT
TOTAL, SELECTED FIELDS	100%	11%	53%	36%	100%	10%	47%	43%
FIELD OF RESEARCH								
ENGINEERING	100%	9%	42%	50%	100%	6%	37%	57%
AGRICULTURAL SCIENCES	100%	8%	47%	44%	100%	8%	39%	52%
BIOLOGICAL SCIENCES, TOTAL	100%	15%	59%	26%	100%	15%	53%	32%
GRADUATE SCHOOLS	100%	14%	48%	39%	100%	15%	42%	43%
MEDICAL SCHOOLS	100%	16%	69%	15%	100%	15%	63%	22%
COMPUTER SCIENCE	100%	2%	52%	45%	100%	2%	52%	46%
ENVIRONMENTAL SCIENCES	100%	10%	66%	25%	100%	10%	54%	36%
MATERIALS SCIENCE	100%	27%	58%	15%	100%	20%	35%	45%
PHYSICAL SCIENCES	100%	4%	54%	42%	100%	2%	49%	49%
INTERDISCIPLINARY, N.E.C.	100%	30%	33%	37%	100%	32%	30%	37%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. FOR PHASE II FIELDS (AGRICULTURAL, BIOLOGICAL AND ENVIRONMENTAL SCIENCES), ESTIMATES ARE AS OF DECEMBER 1983. FOR ALL OTHER FIELDS, ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 912 DEPARTMENTS AND FACILITIES.

NOTE: SUBCATEGORY PERCENTAGES MAY NOT SUM EXACTLY TO TOTAL BECAUSE OF ROUNDING.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 2A. DEPARTMENT/FACILITY ASSESSMENT OF ADEQUACY OF AVAILABLE RESEARCH INSTRUMENTATION, BY PHYSICAL SCIENCES AND ENGINEERING SUBFIELD [1]

	PERCENT OF DEPARTMENTS/FACILITIES ASSESSING INSTRUMENTATION AVAILABLE TO TENURED FACULTY AND EQUIVALENT P.I.s AS:				PERCENT OF DEPARTMENTS/FACILITIES ASSESSING INSTRUMENTATION AVAILABLE TO UNTENURED FACULTY AND EQUIVALENT P.I.s AS:			
	TOTAL	EXCELLENT	ADEQUATE	INSUFFICIENT	TOTAL	EXCELLENT	ADEQUATE	INSUFFICIENT
PHYSICAL SCIENCES AND ENGINEERING								
PHYSICAL SCIENCES, TOTAL	100%	4%	54%	42%	100%	2%	49%	49%
CHEMISTRY	100%	6%	46%	48%	100%	3%	51%	46%
PHYSICS AND ASTRONOMY	100%	2%	61%	37%	100%	2%	47%	51%
ENGINEERING, TOTAL	100%	9%	42%	50%	100%	6%	37%	57%
CHEMICAL	100%	2%	47%	51%	100%	0%	39%	61%
CIVIL	100%	10%	46%	43%	100%	11%	43%	45%
ELECTRICAL	100%	21%	21%	58%	100%	4%	29%	67%
MECHANICAL	100%	19%	27%	54%	100%	19%	11%	70%
METALLURGICAL/MATERIALS	100%	0%	53%	47%	100%	0%	38%	62%
OTHER, N.E.C.	100%	4%	49%	48%	100%	4%	46%	51%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES IN THE NATION. ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 322 DEPARTMENTS AND FACILITIES.

NOTE: SUBCATEGORY PERCENTAGES MAY NOT SUM EXACTLY TO TOTAL BECAUSE OF ROUNDING.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 28. DEPARTMENT/FACILITY ASSESSMENT OF ADEQUACY OF AVAILABLE RESEARCH INSTRUMENTATION, BY AGRICULTURAL AND BIOLOGICAL SCIENCES SUBFIELD [1]

	PERCENT OF DEPARTMENTS/FACILITIES ASSESSING INSTRUMENTATION AVAILABLE TO TENURED FACULTY AND EQUIVALENT P.I.s AS:				PERCENT OF DEPARTMENTS/FACILITIES ASSESSING INSTRUMENTATION AVAILABLE TO UNTENURED FACULTY AND EQUIVALENT P.I.s AS:			
	TOTAL	EXCELLENT	ADEQUATE	INSUFFICIENT	TOTAL	EXCELLENT	ADEQUATE	INSUFFICIENT
AGRICULTURAL AND BIOLOGICAL SCIENCES								
AGRICULTURAL SCIENCES, TOTAL	100%	8%	47%	44%	100%	8%	39%	52%
AGRONOMIC SCIENCES	100%	5%	46%	49%	100%	5%	32%	64%
ANIMAL SCIENCES	100%	14%	53%	34%	100%	14%	46%	40%
NATURAL RESOURCE MGMT	100%	6%	40%	54%	100%	6%	43%	51%
BIOLOGICAL SCIENCES, TOTAL	100%	15%	59%	26%	100%	15%	53%	32%
ANATOMY	100%	12%	67%	22%	100%	0%	78%	22%
BIOCHEMISTRY	100%	25%	61%	14%	100%	27%	56%	17%
BOTANY	100%	14%	19%	67%	100%	14%	18%	68%
FOOD AND NUTRITION	100%	0%	44%	56%	100%	4%	24%	72%
MICROBIOLOGY/IMMUNOLOGY	100%	16%	42%	42%	100%	17%	31%	52%
MOLECULAR/CELLULAR BIOLOGY AND GENETICS	100%	40%	51%	9%	100%	40%	49%	11%
PATHOLOGY	100%	13%	75%	11%	100%	8%	67%	25%
PHARMACOLOGY/TOXICOLOGY	100%	7%	78%	14%	100%	0%	78%	22%
PHYSIOLOGY/BIOPHYSICS	100%	26%	59%	15%	100%	31%	51%	18%
ZOOLOGY/ENTOMOLOGY	100%	7%	49%	45%	100%	7%	34%	59%
BIOLOGY, GENERAL AND N.E.C.	100%	4%	69%	27%	100%	7%	65%	28%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. ESTIMATES ARE AS OF DECEMBER 1983. SAMPLE IS 454 DEPARTMENTS AND FACILITIES.

NOTE: SUBCATEGORY PERCENTAGES MAY NOT SUM EXACTLY TO TOTAL BECAUSE OF ROUNDING.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 3. DEPARTMENT/FACILITY RECOMMENDATIONS FOR INCREASED FEDERAL SUPPORT FOR RESEARCH INSTRUMENTATION, BY FIELD [1]

	PERCENT OF DEPARTMENTS/FACILITIES RECOMMENDING AS TOP PRIORITY AREA FOR INCREASED FEDERAL SUPPORT OF ACADEMIC RESEARCH EQUIPMENT:					
	TOTAL	LARGE SCALE FACILITIES	SYSTEMS IN $50,000-$1,000,000 RANGE	SYSTEMS IN $10,000-$50,000 RANGE	LAB EQUIPMENT UNDER $10,000	OTHER
TOTAL, SELECTED FIELDS	100%	2%	26%	61%	10%	1%
FIELD OF RESEARCH						
ENGINEERING	100%	3%	28%	60%	9%	-
AGRICULTURAL SCIENCES	100%	-	6%	79%	15%	-
BIOLOGICAL SCIENCES, TOTAL	100%	-	20%	66%	13%	2%
GRADUATE SCHOOLS	100%	-	21%	63%	15%	1%
MEDICAL SCHOOLS	100%	-	19%	69%	10%	2%
COMPUTER SCIENCE	100%	-	25%	75%	-	-
ENVIRONMENTAL SCIENCES	100%	6%	36%	54%	2%	2%
MATERIALS SCIENCE	100%	-	83%	17%	-	-
PHYSICAL SCIENCES	100%	5%	43%	44%	6%	2%
INTERDISCIPLINARY, N.E.C.	100%	-	48%	45%	7%	-

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. FOR PHASE II FIELDS (AGRICULTURAL, BIOLOGICAL AND ENVIRONMENTAL SCIENCES), ESTIMATES ARE AS OF DECEMBER 1983. FOR ALL OTHER FIELDS, ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 912 DEPARTMENTS AND FACILITIES.

NOTE: SUBCATEGORY PERCENTAGES MAY NOT SUM EXACTLY TO TOTAL BECAUSE OF ROUNDING.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 3A. DEPARTMENT/FACILITY RECOMMENDATIONS FOR INCREASED FEDERAL SUPPORT FOR RESEARCH INSTRUMENTATION, BY PHYSICAL SCIENCES AND ENGINEERING SUBFIELD [1]

PHYSICAL SCIENCES AND ENGINEERING	PERCENT OF DEPARTMENTS/FACILITIES RECOMMENDING AS TOP PRIORITY AREA FOR INCREASED FEDERAL SUPPORT OF ACADEMIC RESEARCH EQUIPMENT:					
	TOTAL	LARGE SCALE FACILITIES	SYSTEMS IN $50,000-$1,000,000 RANGE	SYSTEMS IN $10,000-$50,000 RANGE	LAB EQUIPMENT UNDER $10,000	OTHER
PHYSICAL SCIENCES, TOTAL	100%	5%	43%	44%	6%	2%
CHEMISTRY	100%	0%	54%	39%	6%	1%
PHYSICS AND ASTRONOMY	100%	9%	33%	48%	7%	3%
ENGINEERING, TOTAL	100%	3%	28%	60%	9%	0%
CHEMICAL	100%	0%	10%	70%	20%	0%
CIVIL	100%	5%	6%	89%	0%	0%
ELECTRICAL	100%	10%	52%	23%	15%	0%
MECHANICAL	100%	3%	27%	67%	0%	4%
METALLURGICAL/MATERIALS	100%	0%	62%	32%	6%	0%
OTHER, N.E.C.	100%	1%	31%	59%	10%	0%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES IN THE NATION. ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 322 DEPARTMENTS AND FACILITIES.

NOTE: SUBCATEGORY PERCENTAGES MAY NOT SUM EXACTLY TO TOTAL BECAUSE OF ROUNDING.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 3B. DEPARTMENT/FACILITY RECOMMENDATIONS FOR INCREASED FEDERAL SUPPORT FOR RESEARCH INSTRUMENTATION, BY AGRICULTURAL AND BIOLOGICAL SCIENCES SUBFIELD [1]

	PERCENT OF DEPARTMENTS/FACILITIES RECOMMENDING AS TOP PRIORITY AREA FOR INCREASED FEDERAL SUPPORT OF ACADEMIC RESEARCH EQUIPMENT:					
	TOTAL	LARGE SCALE FACILITIES	SYSTEMS IN $50,000-$1,000,000 RANGE	SYSTEMS IN $10,000-$50,000 RANGE	LAB EQUIPMENT UNDER $10,000	OTHER
AGRICULTURAL AND BIOLOGICAL SCIENCES						
AGRICULTURAL SCIENCES, TOTAL	100%	0%	6%	79%	15%	0%
AGRONOMIC SCIENCES	100%	0%	8%	80%	12%	0%
ANIMAL SCIENCES	100%	0%	2%	82%	16%	0%
NATURAL RESOURCE MGMT	100%	0%	10%	72%	18%	0%
BIOLOGICAL SCIENCES, TOTAL	100%	0%	20%	66%	13%	2%
ANATOMY	100%	0%	18%	76%	7%	0%
BIOCHEMISTRY	100%	0%	24%	59%	8%	9%
BOTANY	100%	0%	25%	49%	27%	0%
FOOD AND NUTRITION	100%	0%	15%	74%	7%	4%
MICROBIOLOGY/IMMUNOLOGY	100%	0%	20%	55%	24%	0%
MOLECULAR/CELLULAR BIOLOGY AND GENETICS	100%	0%	31%	54%	13%	0%
PATHOLOGY	100%	0%	24%	56%	20%	0%
PHARMACOLOGY/TOXICOLOGY	100%	0%	8%	90%	1%	0%
PHYSIOLOGY/BIOPHYSICS	100%	0%	17%	82%	2%	0%
ZOOLOGY/ENTOMOLOGY	100%	0%	5%	70%	26%	0%
BIOLOGY, GENERAL AND N.E.C.	100%	0%	22%	64%	11%	3%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. ESTIMATES ARE AS OF DECEMBER 1983. SAMPLE IS 454 DEPARTMENTS AND FACILITIES.

NOTE: SUBCATEGORY PERCENTAGES MAY NOT SUM EXACTLY TO TOTAL BECAUSE OF ROUNDING.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 4. TOTAL AMOUNT OF ACADEMIC RESEARCH INSTRUMENTATION IN NATIONAL STOCK AND MEAN PRICE PER SYSTEM, BY FIELD [1]

[DOLLARS IN THOUSANDS]

	NUMBER AND PERCENT OF INSTRUMENT SYSTEMS	AGGREGATE PURCHASE PRICE AND PERCENT OF PRICE	MEAN PURCHASE PRICE PER SYSTEM
TOTAL, SELECTED FIELDS	46738 100%	$1630780 100%	$35
FIELD OF RESEARCH			
ENGINEERING	9425 20%	333613 20%	35
AGRICULTURAL SCIENCES	1954 4%	42599 3%	22
BIOLOGICAL SCIENCES, TOTAL	17618 38%	471288 29%	27
GRADUATE SCHOOLS	7290 16%	186272 11%	26
MEDICAL SCHOOLS	10328 22%	285016 17%	28
COMPUTER SCIENCE	1115 2%	60026 4%	54
ENVIRONMENTAL SCIENCES	2679 6%	126231 8%	47
MATERIALS SCIENCE	731 2%	37120 2%	51
PHYSICAL SCIENCES	11644 25%	481881 30%	41
INTERDISCIPLINARY, N.E.C.	1571 3%	78022 5%	50

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. FOR PHASE II FIELDS (AGRICULTURAL, BIOLOGICAL AND ENVIRONMENTAL SCIENCES), ESTIMATES ARE AS OF DECEMBER 1983. FOR ALL OTHER FIELDS, ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 8704 INSTRUMENT SYSTEMS.

NOTE: SUBCATEGORY NUMBERS AND PERCENTAGES MAY NOT SUM EXACTLY TO TOTAL BECAUSE OF ROUNDING. ESTIMATED TOTALS MAY VARY SLIGHTLY FROM TABLE TO TABLE.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 4A. TOTAL AMOUNT OF ACADEMIC RESEARCH INSTRUMENTATION IN NATIONAL STOCK AND MEAN PRICE PER SYSTEM, BY PHYSICAL SCIENCES AND ENGINEERING SUBFIELD [1]

(DOLLARS IN THOUSANDS)

	NUMBER AND PERCENT OF INSTRUMENT SYSTEMS	AGGREGATE PURCHASE PRICE AND PERCENT OF PRICE	MEAN PURCHASE PRICE PER SYSTEM
PHYSICAL SCIENCES AND ENGINEERING			
PHYSICAL SCIENCES, TOTAL	11644 100%	9481881 100%	841
CHEMISTRY	6415 55%	254560 53%	40
PHYSICS AND ASTRONOMY	5229 45%	227321 47%	43
ENGINEERING, TOTAL	9425 100%	333613 100%	35
CHEMICAL	847 9%	27393 8%	32
CIVIL	693 7%	22287 7%	32
ELECTRICAL	2218 24%	82681 25%	37
MECHANICAL	1859 20%	67093 20%	36
METALLURGICAL/MATERIALS	1244 13%	46352 14%	37
OTHER, N.E.C.	2565 27%	87808 26%	34

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES IN THE NATION. ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 3232 INSTRUMENT SYSTEMS.

NOTE: SUBCATEGORY NUMBERS AND PERCENTAGES MAY NOT SUM EXACTLY TO TOTAL BECAUSE OF ROUNDING. ESTIMATED TOTALS MAY VARY SLIGHTLY FROM TABLE TO TABLE.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 4B. TOTAL AMOUNT OF ACADEMIC RESEARCH INSTRUMENTION IN NATIONAL STOCK AND MEAN PRICE PER SYSTEM, BY AGRICULTURAL AND BIOLOGICAL SCIENCES SUBFIELD [1]

[DOLLARS IN THOUSANDS]

	NUMBER AND PERCENT OF INSTRUMENT SYSTEMS	AGGREGATE PURCHASE PRICE AND PERCENT OF PRICE	MEAN PURCHASE PRICE PER SYSTEM
AGRICULTURAL AND BIOLOGICAL SCIENCES			
AGRICULTURAL SCIENCES, TOTAL	1954 100%	$42599 100%	$22
AGRONOMIC SCIENCES	1229 63%	27407 64%	22
ANIMAL SCIENCES	485 25%	9924 23%	20
NATURAL RESOURCE MGMT	240 12%	5268 12%	22
BIOLOGICAL SCIENCES, TOTAL	17618 100%	471288 100%	27
ANATOMY	546 3%	18311 4%	34
BIOCHEMISTRY	4078 23%	97391 21%	24
BOTANY	471 3%	12083 3%	26
FOOD AND NUTRITION	452 3%	10189 2%	23
MICROBIOLOGY/IMMUNOLOGY	1443 8%	35781 8%	25
MOLECULAR/CELLULAR BIOLOGY AND GENETICS	2841 16%	81874 17%	29
PATHOLOGY	999 6%	31038 7%	31
PHARMACOLOGY/TOXICOLOGY	1977 11%	44907 10%	23
PHYSIOLOGY/BIOPHYSICS	2384 14%	68628 15%	29
ZOOLOGY/ENTOMOLOGY	495 3%	13181 3%	27
BIOLOGY, GENERAL AND N.E.C.	1933 11%	57905 12%	30

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 137 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. ESTIMATES ARE AS OF DECEMBER 1983. SAMPLE IS 4263 INSTRUMENT SYSTEMS.

NOTE: SUBCATEGORY NUMBERS AND PERCENTS MAY NOT SUM EXACTLY TO TOTAL BECAUSE OF ROUNDING. ESTIMATED TOTALS MAY VARY SLIGHTLY FROM TABLE TO TABLE.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 2. INDICES OF EQUIPMENT-EXTENSIVENESS OF SELECTED FIELDS AND SUBFIELDS OF ACADEMIC RESEARCH

	[DOLLARS IN MILLIONS]				[IN DOLLARS]		[IN DOLLARS]
	TOTAL PURCHASE PRICE OF NATIONAL STOCK OF ACADEMIC RESEARCH EQUIPMENT [2]	TOTAL ACADEMIC R & D EXPENDITURES, FY 1982 [3]	TOTAL PRICE OF NATIONAL STOCK AS PERCENT OF FY 1982 R & D EXPENDITURES	GRADUATE STUDENT ENROLLMENT, FALL 1982 [4]	TOTAL PRICE OF NATIONAL STOCK PER GRADUATE STUDENT	NUMBER OF ACADEMIC SCIENTISTS/ ENGINEERS, JANUARY 1983 [5]	TOTAL PRICE OF NATIONAL STOCK PER SCIENTIST/ ENGINEER
TOTAL, SELECTED FIELDS	$1516	$4684	32%	190500	$8000	107000	$14200
FIELD AND SUBFIELD [1]							
ENGINEERING, TOTAL	334	1025	33%	80500	4200	26200	12700
CHEMICAL	27	83	33%	7000	3900	2100	12900
CIVIL	22	108	20%	13700	1600	4400	5000
ELECTRICAL	83	224	37%	20600	4000	6000	13800
MECHANICAL	67	142	47%	10900	6100	4200	16000
OTHER, N.E.C.	134	467	29%	28300	4700	9400	14300
AGRICULTURAL SCIENCES	43	838	5%	11800	3600	14100	3000
BIOLOGICAL SCIENCES	471	1290	37%	42000	11200	34000	13900
COMPUTER SCIENCE	60	148	41%	16200	3700	6300	9500
ENVIRONMENTAL SCIENCES	126	560	22%	13500	9300	7000	18000
PHYSICAL SCIENCES, TOTAL	482	823	59%	26500	18200	19400	24800
CHEMISTRY	255	311	82%	15800	16100	9400	27100
PHYSICS & ASTRONOMY	227	512	44%	10700	21200	10000	22700

[1] TABLE IS LIMITED TO FIELDS AND SUBFIELDS FOR WHICH COMPARATIVE DATA ARE AVAILABLE.

[2] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. FOR PHASE II FIELDS (AGRICULTURAL, BIOLOGICAL AND ENVIRONMENTAL SCIENCES), ESTIMATES ARE AS OF DECEMBER 1983. FOR ALL OTHER FIELDS, ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 5704 INSTRUMENT SYSTEMS.

[3] FROM ACADEMIC SCIENCE/ENGINEERING: R & D FUNDS, FISCAL YEAR 1982, SURVEY OF SCIENCE RESOURCES SERIES, NATIONAL SCIENCE FOUNDATION, 1984 (GPO PUBLICATION NO. NSF 84-308), p. 8.

[4] DOCTORAL-GRANTING INSTITUTIONS ONLY. FROM ACADEMIC SCIENCE/ENGINEERING: GRADUATE ENROLLMENT AND SUPPORT, FALL 1982, SURVEYS OF SCIENCE RESOURCES SERIES, NATIONAL SCIENCE FOUNDATION, 1984 (GPO PUBLICATION NO. NSF 84-306), p. 20.

[5] DOCTORAL-GRANTING INSTITUTIONS ONLY. FROM ACADEMIC SCIENCE/ENGINEERING: SCIENTISTS AND ENGINEERS, JANUARY 1982, SURVEYS OF SCIENCE RESOURCES SERIES, NATIONAL SCIENCE FOUNDATION, 1984 (GPO PUBLICATION NO. NSF 84-309), p. 9.

NOTE: SUBCATEGORY NUMBERS AND PERCENTAGES MAY NOT SUM EXACTLY TO TOTAL BECAUSE OF ROUNDING.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 6. MEAN AMOUNT OF ACADEMIC RESEARCH EQUIPMENT PER INSTITUTION, BY UNIVERSITY CONTROL AND BY FIELD [1]

[DOLLARS IN THOUSANDS]

	UNIVERSITY CONTROL					
	TOTAL		PRIVATE		PUBLIC	
	MEAN NUMBER OF SYSTEMS	MEAN AGGREGATE PURCHASE PRICE	MEAN NUMBER OF SYSTEMS	MEAN AGGREGATE PURCHASE PRICE	MEAN NUMBER OF SYSTEMS	MEAN AGGREGATE PURCHASE PRICE
TOTAL, SELECTED FIELDS	232	$8572	228	$8820	234	$8443
FIELD OF RESEARCH						
ENGINEERING	60	2125	56	2216	62	2078
AGRICULTURAL SCIENCES	12	271	2	29	18	395
BIOLOGICAL SCIENCES, TOTAL	71	1893	65	1956	74	1855
GRADUATE SCHOOLS	46	1186	44	1182	48	1189
MEDICAL SCHOOLS	112	3098	93	2982	127	3187
COMPUTER SCIENCE	7	382	12	705	5	218
ENVIRONMENTAL SCIENCES	17	804	13	691	19	862
MATERIALS SCIENCE	5	236	8	403	3	151
PHYSICAL SCIENCES	74	3069	81	3264	71	2970
INTERDISCIPLINARY, N.E.C.	10	497	12	329	9	582

[1] ESTIMATES FOR BIOLOGICAL SCIENCES IN MEDICAL SCHOOLS HAVE A BASE OF 92 MEDICAL SCHOOLS (40 PRIVATE, 52 PUBLIC). ESTIMATES FOR 'BIOLOGICAL SCIENCES, TOTAL' HAVE A BASE OF 249 INSTITUTIONS (92 MEDICAL SCHOOLS AND 157 UNIVERSITIES). ALL OTHER ESTIMATES ARE BASED ON 157 UNIVERSITIES (53 PRIVATE, 104 PUBLIC). FOR PHASE II FIELDS (AGRICULTURAL, BIOLOGICAL AND ENVIRONMENTAL SCIENCES), ESTIMATES ARE AS OF DECEMBER 1983. FOR ALL OTHER FIELDS, ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 8704 INSTRUMENT SYSTEMS.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 6A. MEAN AMOUNT OF ACADEMIC RESEARCH EQUIPMENT PER INSTITUTION, BY UNIVERSITY CONTROL AND BY PHYSICAL SCIENCES AND ENGINEERING SUBFIELD [1]

[DOLLARS IN THOUSANDS]

	TOTAL		UNIVERSITY CONTROL: PRIVATE		UNIVERSITY CONTROL: PUBLIC	
PHYSICAL SCIENCES AND ENGINEERING	MEAN NUMBER OF SYSTEMS	MEAN AGGREGATE PURCHASE PRICE	MEAN NUMBER OF SYSTEMS	MEAN AGGREGATE PURCHASE PRICE	MEAN NUMBER OF SYSTEMS	MEAN AGGREGATE PURCHASE PRICE
PHYSICAL SCIENCES, TOTAL	74	$3069	81	$3264	71	$2970
CHEMISTRY	41	1621	43	1699	40	1582
PHYSICS AND ASTRONOMY	33	1448	38	1565	31	1388
ENGINEERING, TOTAL	60	2125	56	2216	62	2078
CHEMICAL	5	174	5	224	5	149
CIVIL	4	142	2	79	6	174
ELECTRICAL	14	527	11	588	16	495
MECHANICAL	12	427	17	574	9	352
METALLUGICAL/MATERIALS	8	295	7	280	8	303
OTHER, N.E.C.	16	559	13	471	18	604

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES IN THE NATION. ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 3232 INSTRUMENT SYSTEMS

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 68. MEAN AMOUNT OF ACADEMIC RESEARCH EQUIPMENT PER INSTITUTION, BY UNIVERSITY CONTROL AND BY AGICULTURAL AND BIOLOGICAL SCIENCES SUBFIELD [1]

[DOLLARS IN THOUSANDS]

	UNIVERSITY CONTROL					
	TOTAL		PRIVATE		PUBLIC	
	MEAN NUMBER OF SYSTEMS	MEAN AGGREGATE PURCHASE PRICE	MEAN NUMBER OF SYSTEMS	MEAN AGGREGATE PURCHASE PRICE	MEAN NUMBER OF SYSTEMS	MEAN AGGREGATE PURCHASE PRICE
AGRICULTURAL AND BIOLOGICAL SCIENCES						
AGRICULTURAL SCIENCES, TOTAL	12	9271	2	929	18	6395
AGRONOMIC SCIENCES	9	175	1	19	11	254
ANIMAL SCIENCES	3	63	-	5	4	93
NATURAL RESOURCE MGMT	2	34	-	4	2	49
BIOLOGICAL SCIENCES, TOTAL	71	1893	65	1956	74	1855
ANATOMY	2	74	2	69	3	76
BIOCHEMISTRY	16	391	14	349	18	416
BOTANY	2	49	1	30	2	60
FOOD AND NUTRITION	2	41	1	15	2	57
MICROBIOLOGY/IMMUNOLOGY	6	144	4	91	7	175
MOLECULAR/CELLULAR BIOLOGY AND GENETICS	11	329	15	473	9	243
PATHOLOGY	4	125	3	111	4	133
PHARMACOLOGY/TOXICOLOGY	8	180	7	178	9	182
PHYSIOLOGY/BIOPHYSICS	10	276	10	373	9	217
ZOOLOGY/ENTOMOLOGY	2	53	2	67	2	45
BIOLOGY, GENERAL AND N.E.C.	8	233	6	202	9	251

[1] ALL ESTIMATES FOR AGRICULTURAL SCIENCES ARE BASED ON 137 UNIVERSITIES (53 PRIVATE, 104 PUBLIC). ESTIMATES FOR ALL BIOLOGICAL SCIENCE SUBFIELDS ARE BASED ON 249 UNIVERSITIES AND MEDICAL SCHOOLS (93 PRIVATE, 156 PUBLIC). ESTIMATES ARE AS OF DECEMBER 1983. SAMPLE IS 4263 INSTRUMENT SYSTEMS.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 7. DISTRIBUTION OF ACADEMIC RESEARCH INSTRUMENT SYSTEMS IN NATIONAL STOCK, BY SYSTEM PURCHASE PRICE AND BY FIELD [1]

	NUMBER AND PERCENT OF SYSTEMS			
		SYSTEM PURCHASE PRICE		
	TOTAL	$10,000-$24,999	$25,000-$74,999	$75,000-$1,000,000
TOTAL, SELECTED FIELDS	46738	29699	13115	3924
	100%	64%	28%	8%
FIELD OF RESEARCH				
ENGINEERING	9425	5785	2828	812
	100%	61%	30%	9%
AGRICULTURAL SCIENCES	1954	1512	480	42
	100%	77%	24%	2%
BIOLOGICAL SCIENCES, TOTAL	17619	12586	4218	814
	100%	71%	24%	5%
GRADUATE SCHOOLS	7290	5241	1747	302
	100%	72%	24%	4%
MEDICAL SCHOOLS	10329	7345	2472	511
	100%	71%	24%	5%
COMPUTER SCIENCE	1115	525	441	150
	100%	47%	40%	13%
ENVIRONMENTAL SCIENCES	2679	1455	879	343
	100%	54%	33%	13%
MATERIALS SCIENCE	731	387	223	121
	100%	53%	31%	17%
PHYSICAL SCIENCES	11644	6358	3820	1466
	100%	55%	33%	13%
INTERDISCIPLINARY, N.E.C.	1571	1091	305	175
	100%	69%	19%	11%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. FOR PHASE II FIELDS (AGRICULTURAL, BIOLOGICAL AND ENVIRONMENTAL SCIENCES), ESTIMATES ARE AS OF DECEMBER 1983. FOR ALL OTHER FIELDS, ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 8704 INSTRUMENT SYSTEMS.

NOTE: SUBCATEGORY NUMBERS AND PERCENTAGES MAY NOT SUM EXACTLY TO TOTAL BECAUSE OF ROUNDING. ESTIMATED TOTALS MAY VARY SLIGHTLY FROM TABLE TO TABLE.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 7A. DISTRIBUTION OF ACADEMIC RESEARCH INSTRUMENT SYSTEMS IN NATIONAL STOCK, BY SYSTEM PURCHASE PRICE AND BY PHYSICAL SCIENCES AND ENGINEERING SUBFIELD (1)

	NUMBER AND PERCENT OF SYSTEMS			
		SYSTEM PURCHASE PRICE		
	TOTAL	$10,000-$24,999	$25,000-$74,999	$75,000-$1,000,000
PHYSICAL SCIENCES AND ENGINEERING				
PHYSICAL SCIENCES, TOTAL	11644	6358	3820	1466
	100%	55%	33%	13%
CHEMISTRY	6415	3602	2015	797
	100%	56%	31%	12%
PHYSICS AND ASTRONOMY	5229	2756	1805	668
	100%	53%	35%	13%
ENGINEERING, TOTAL	9425	5785	2839	812
	100%	61%	30%	9%
CHEMICAL	847	481	311	56
	100%	57%	37%	7%
CIVIL	693	475	157	61
	100%	68%	23%	9%
ELECTRICAL	2218	1336	672	210
	100%	60%	30%	9%
MECHANICAL	1859	1187	512	160
	100%	64%	28%	9%
METALLURGICAL/MATERIALS	1244	689	409	146
	100%	55%	33%	12%
OTHER, N.E.C.	2565	1617	760	188
	100%	63%	30%	7%

(1) ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES IN THE NATION. ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 3232 INSTRUMENT SYSTEMS.

NOTE: SUBCATEGORY NUMBERS AND PERCENTAGES MAY NOT SUM EXACTLY TO TOTAL BECAUSE OF ROUNDING. ESTIMATED TOTALS MAY VARY SLIGHTLY FROM TABLE TO TABLE.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 79. DISTRIBUTION OF ACADEMIC RESEARCH INSTRUMENT SYSTEMS IN NATIONAL STOCK, BY SYSTEM PURCHASE PRICE AND BY AGRICULTURAL AND BIOLOGICAL SCIENCES SUBFIELD [1]

	NUMBER AND PERCENT OF SYSTEMS			
		SYSTEM PURCHASE PRICE		
	TOTAL	$10,000-$24,999	$25,000-$74,999	$75,000-$1,000,000
AGRICULTURAL AND BIOLOGICAL SCIENCES				
AGRICULTURAL SCIENCES, TOTAL	1954	1512	400	42
	100%	77%	20%	2%
AGRONOMIC SCIENCES	1229	939	257	32
	100%	76%	21%	3%
ANIMAL SCIENCES	485	389	92	5
	100%	80%	19%	1%
NATURAL RESOURCE MGMT	240	184	51	6
	100%	77%	21%	2%
BIOLOGICAL SCIENCES, TOTAL	17618	12586	4218	814
	100%	71%	24%	5%
ANATOMY	546	388	200	46
	100%	55%	37%	8%
BIOCHEMISTRY	4078	3108	859	110
	100%	76%	21%	3%
BOTANY	471	369	73	29
	100%	78%	16%	6%
FOOD AND NUTRITION	452	318	124	9
	100%	70%	28%	2%
MICROBIOLOGY/IMMUNOLOGY	1443	1061	335	47
	100%	73%	23%	3%
MOLECULAR/CELLULAR BIOLOGY AND GENETICS	2941	1957	817	137
	100%	66%	29%	5%
PATHOLOGY	999	597	313	88
	100%	60%	31%	9%
PHARMACOLOGY/TOXICOLOGY	1977	1571	337	69
	100%	79%	17%	4%
PHYSIOLOGY/BIOPHYSICS	2394	1662	594	128
	100%	70%	25%	5%
ZOOLOGY/ENTOMOLOGY	495	359	108	28
	100%	72%	22%	6%
BIOLOGY, GENERAL AND N.E.C.	1933	1354	457	122
	100%	70%	24%	6%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. ESTIMATES ARE AS OF DECEMBER 1983. SAMPLE IS 4263 INSTRUMENT SYSTEMS.

NOTE: SUBCATEGORY NUMBERS AND PERCENTAGES MAY NOT SUM EXACTLY TO TOTAL BECAUSE OF ROUNDING. ESTIMATED TOTALS MAY VARY SLIGHTLY FROM TABLE TO TABLE.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE B. DISTRIBUTION OF AGGREGATE PRICE OF ACADEMIC RESEARCH INSTRUMENT SYSTEMS IN NATIONAL STOCK, BY SYSTEM PURCHASE PRICE AND BY FIELD [1]

[DOLLARS IN MILLIONS]

	AGGREGATE PURCHASE PRICE AND PERCENT OF PRICE-SYSTEM PURCHASE PRICE			
	TOTAL	$10,000-$24,999	$25,000-$74,999	$75,000-$1,000,000
TOTAL, SELECTED FIELDS	$1630.78	$463.77	$520.37	$646.64
	100%	28%	32%	40%
FIELD OF RESEARCH				
ENGINEERING	333.61	89.46	111.99	132.16
	100%	27%	34%	40%
AGRICULTURAL SCIENCES	42.60	23.22	14.33	4.94
	100%	55%	34%	12%
BIOLOGICAL SCIENCES, TOTAL	471.29	197.29	160.13	113.87
	100%	42%	34%	24%
GRADUATE SCHOOLS	186.27	81.04	64.32	40.91
	100%	44%	35%	22%
MEDICAL SCHOOLS	285.02	116.25	95.81	72.96
	100%	41%	34%	26%
COMPUTER SCIENCE	60.03	8.54	17.53	33.95
	100%	14%	29%	57%
ENVIRONMENTAL SCIENCES	126.23	22.24	36.04	67.95
	100%	18%	29%	54%
MATERIALS SCIENCE	37.12	5.91	11.06	20.15
	100%	16%	30%	54%
PHYSICAL SCIENCES	481.89	100.21	153.94	227.73
	100%	21%	32%	47%
INTERDISCIPLINARY, N.E.C.	78.02	16.79	15.35	45.88
	100%	22%	20%	59%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 197 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. FOR PHASE II FIELDS (AGRICULTURAL, BIOLOGICAL AND ENVIRONMENTAL SCIENCES), ESTIMATES ARE AS OF DECEMBER 1983. FOR ALL OTHER FIELDS, ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 8704 INSTRUMENT SYSTEMS.

NOTE: SUBCATEGORY NUMBERS AND PERCENTAGES MAY NOT SUM EXACTLY TO TOTAL BECAUSE OF ROUNDING. ESTIMATED TOTALS MAY VARY SLIGHTLY FROM TABLE TO TABLE.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 8A. DISTRIBUTION OF AGGREGATE PRICE OF ACADEMIC RESEARCH INSTRUMENT SYSTEMS IN NATIONAL STOCK, BY SYSTEM PURCHASE PRICE AND BY PHYSICAL SCIENCES AND ENGINEERING SUBFIELD [1]

[DOLLARS IN MILLIONS]

	-AGGREGATE PURCHASE PRICE AND PERCENT OF PRICE-			
		-------SYSTEM PURCHASE PRICE------		
	TOTAL	$10,000-$24,999	$25,000-$74,999	$75,000-$1,000,000
PHYSICAL SCIENCES AND ENGINEERING				
PHYSICAL SCIENCES, TOTAL	$481.88	$100.21	$153.94	$227.73
	100%	21%	32%	47%
CHEMISTRY	254.56	57.20	82.24	115.12
	100%	22%	32%	45%
PHYSICS AND ASTRONOMY	227.32	43.01	71.70	112.61
	100%	19%	32%	50%
ENGINEERING, TOTAL	333.61	89.46	111.99	132.16
	100%	27%	34%	40%
CHEMICAL	27.39	7.44	13.23	6.73
	100%	27%	48%	25%
CIVIL	22.29	6.98	6.38	8.92
	100%	31%	29%	40%
ELECTRICAL	82.68	20.93	26.53	35.22
	100%	25%	32%	43%
MECHANICAL	67.09	18.48	20.44	28.17
	100%	28%	30%	42%
METALLURGICAL/MATERIALS	46.35	11.23	15.53	19.60
	100%	24%	33%	42%
OTHER, N.E.C.	87.81	24.39	29.89	33.53
	100%	28%	34%	38%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES IN THE NATION. ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 3232 INSTRUMENT SYSTEMS.

NOTE: SUBCATEGORY NUMBERS AND PERCENTAGES MAY NOT SUM EXACTLY TO TOTAL BECAUSE OF ROUNDING. ESTIMATED TOTALS MAY VARY SLIGHTLY FROM TABLE TO TABLE.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE BB. DISTRIBUTION OF AGGREGATE PRICE OF ACADEMIC RESEARCH INSTRUMENT SYSTEMS IN NATIONAL STOCK, BY SYSTEM PURCHASE PRICE AND BY AGRICULTURAL AND BIOLOGICAL SCIENCES SUBFIELD [1]

[DOLLARS IN MILLIONS]

	-AGGREGATE PURCHASE PRICE AND PERCENT OF PRICE-			
		------SYSTEM PURCHASE PRICE-------		
	TOTAL	$10,000-$24,999	$25,000-$74,999	$75,000-$1,000,000
AGRICULTURAL AND BIOLOGICAL SCIENCES				
AGRICULTURAL SCIENCES, TOTAL	$42.60	$23.33	$14.33	$4.94
	100%	55%	34%	12%
AGRONOMIC SCIENCES	27.41	14.18	9.40	3.83
	100%	52%	34%	14%
ANIMAL SCIENCES	9.92	6.28	3.15	.50
	100%	63%	32%	5%
NATURAL RESOURCE MGMT	5.27	2.88	1.78	.61
	100%	55%	34%	12%
BIOLOGICAL SCIENCES, TOTAL	471.29	197.29	160.13	113.87
	100%	42%	34%	24%
ANATOMY	18.31	4.49	9.18	4.64
	100%	24%	50%	25%
BIOCHEMISTRY	97.39	49.88	30.63	16.88
	100%	51%	31%	17%
BOTANY	12.08	5.85	2.80	3.43
	100%	48%	23%	28%
FOOD AND NUTRITION	10.19	4.85	4.53	.81
	100%	48%	44%	8%
MICROBIOLOGY/IMMUNOLOGY	35.78	16.63	12.35	6.80
	100%	46%	35%	19%
MOLECULAR/CELLULAR BIOLOGY AND GENETICS	81.87	29.26	31.30	21.31
	100%	36%	38%	26%
PATHOLOGY	31.04	9.01	12.58	9.44
	100%	29%	41%	30%
PHARMACOLOGY/TOXICOLOGY	44.91	24.55	11.58	8.77
	100%	55%	26%	20%
PHYSIOLOGY/BIOPHYSICS	68.63	26.20	22.79	19.63
	100%	38%	33%	29%
ZOOLOGY/ENTOMOLOGY	13.18	5.43	4.20	3.55
	100%	41%	32%	27%
BIOLOGY, GENERAL AND N.E.C.	57.90	21.13	18.18	18.59
	100%	36%	31%	32%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. ESTIMATES ARE AS OF DECEMBER 1983. SAMPLE IS 4263 INSTRUMENT SYSTEMS.

NOTE: SUBCATEGORY NUMBERS AND PERCENTAGES MAY NOT SUM EXACTLY TO TOTAL BECAUSE OF ROUNDING. ESTIMATED TOTALS MAY VARY SLIGHTLY FROM TABLE TO TABLE.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 9. RESEARCH STATUS OF ACADEMIC RESEARCH INSTRUMENT SYSTEMS IN NATIONAL STOCK, BY FIELD [1]

	NUMBER AND PERCENT OF SYSTEMS				
		SYSTEM RESEARCH STATUS			
		IN RESEARCH USE		NOT YET IN	NO LONGER
	TOTAL	STATE-OF-THE-ART	OTHER	RESEARCH USE	IN RESEARCH USE
TOTAL, SELECTED FIELDS	46767	8075	28399	771	9522
	100%	17%	61%	2%	20%
FIELD OF RESEARCH					
ENGINEERING	9425	1699	5111	327	2288
	100%	18%	54%	3%	24%
AGRICULTURAL SCIENCES	1954	437	1215	24	277
	100%	22%	62%	1%	14%
BIOLOGICAL SCIENCES, TOTAL	17633	3268	11834	124	2406
	100%	19%	67%	1%	14%
GRADUATE SCHOOLS	7300	1435	4958	32	874
	100%	20%	68%	-	12%
MEDICAL SCHOOLS	10333	1833	6876	92	1532
	100%	18%	67%	1%	15%
COMPUTER SCIENCE	1115	186	692	65	172
	100%	17%	62%	6%	15%
ENVIRONMENTAL SCIENCES	2682	518	1608	48	508
	100%	19%	60%	2%	19%
MATERIALS SCIENCE	731	116	534	3	78
	100%	16%	73%	-	11%
PHYSICAL SCIENCES	11656	1725	7076	161	2694
	100%	15%	61%	1%	23%
INTERDISCIPLINARY, N.E.C.	1571	125	329	19	1099
	100%	8%	21%	1%	70%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. FOR PHASE II FIELDS (AGRICULTURAL, BIOLOGICAL AND ENVIRONMENTAL SCIENCES), ESTIMATES ARE AS OF DECEMBER 1983. FOR ALL OTHER FIELDS, ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 8704 INSTRUMENT SYSTEMS.

NOTE: SUBCATEGORY NUMBERS AND PERCENTAGES MAY NOT SUM EXACTLY TO TOTAL BECAUSE OF ROUNDING. ESTIMATED TOTALS MAY VARY SLIGHTLY FROM TABLE TO TABLE.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 9A. RESEARCH STATUS OF ACADEMIC RESEARCH INSTRUMENT SYSTEMS IN NATIONAL STOCK, BY PHYSICAL SCIENCES AND ENGINEERING SUBFIELD [1]

	NUMBER AND PERCENT OF SYSTEMS				
	SYSTEM RESEARCH STATUS				
		IN RESEARCH USE		NOT YET IN RESEARCH USE	NO LONGER IN RESEARCH USE
	TOTAL	STATE-OF-THE-ART	OTHER		
PHYSICAL SCIENCES AND ENGINEERING					
PHYSICAL SCIENCES, TOTAL	11656	1725	7076	161	2694
	100%	15%	61%	1%	23%
CHEMISTRY	6420	893	3969	91	1468
	100%	14%	62%	1%	23%
PHYSICS AND ASTRONOMY	5236	833	3107	70	1226
	100%	16%	59%	1%	23%
ENGINEERING, TOTAL	9425	1699	5111	327	2288
	100%	18%	54%	3%	24%
CHEMICAL	847	134	542	4	167
	100%	16%	64%	-	20%
CIVIL	693	91	304	110	188
	100%	13%	44%	16%	27%
ELECTRICAL	2218	393	1123	22	680
	100%	18%	51%	1%	31%
MECHANICAL	1859	346	996	85	431
	100%	19%	54%	5%	23%
METALLURGICAL/MATERIALS	1244	192	906	26	119
	100%	15%	73%	2%	10%
OTHER, N.E.C.	2565	543	1240	79	702
	100%	21%	48%	3%	27%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES IN THE NATION. ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 3232 INSTRUMENT SYSTEMS.

NOTE: SUBCATEGORY NUMBERS AND PERCENTAGES MAY NOT SUM EXACTLY TO TOTAL BECAUSE OF ROUNDING. ESTIMATED TOTALS MAY VARY SLIGHTLY FROM TABLE TO TABLE.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 9B. RESEARCH STATUS OF ACADEMIC RESEARCH INSTRUMENT SYSTEMS IN NATIONAL STOCK, BY AGRICULTURAL AND BIOLOGICAL SCIENCES SUBFIELD (1)

	NUMBER AND PERCENT OF SYSTEMS				
	SYSTEM RESEARCH STATUS				
		IN RESEARCH USE		NOT YET IN RESEARCH USE	NO LONGER IN RESEARCH USE
	TOTAL	STATE-OF-THE-ART	OTHER		
AGRICULTURAL AND BIOLOGICAL SCIENCES					
AGRICULTURAL SCIENCES, TOTAL	1954	437	1215	24	277
	100%	22%	62%	1%	14%
AGRONOMIC SCIENCES	1229	294	748	8	178
	100%	24%	61%	1%	14%
ANIMAL SCIENCES	485	113	316	12	43
	100%	23%	65%	3%	9%
NATURAL RESOURCE MGMT	240	30	151	3	56
	100%	13%	63%	1%	23%
BIOLOGICAL SCIENCES, TOTAL	17633	3268	11834	124	2406
	100%	19%	67%	1%	14%
ANATOMY	549	143	319	0	87
	100%	26%	58%	-	16%
BIOCHEMISTRY	4078	696	3007	2	373
	100%	17%	74%	-	9%
BOTANY	471	108	330	0	33
	100%	23%	70%	-	7%
FOOD AND NUTRITION	452	74	314	8	55
	100%	16%	70%	2%	12%
MICROBIOLOGY/IMMUNOLOGY	1443	222	1033	2	186
	100%	15%	72%	-	13%
MOLECULAR/CELLULAR BIOLOGY AND GENETICS	2845	807	1937	0	101
	100%	28%	68%	-	4%
PATHOLOGY	999	163	596	17	223
	100%	16%	60%	2%	22%
PHARMACOLOGY/TOXICOLOGY	1977	235	1413	32	296
	100%	12%	72%	2%	15%
PHYSIOLOGY/BIOPHYSICS	2384	436	1570	41	338
	100%	18%	66%	2%	14%
ZOOLOGY/ENTOMOLOGY	503	124	300	2	77
	100%	25%	60%	-	15%
BIOLOGY, GENERAL AND N.E.C.	1933	260	1015	21	638
	100%	13%	52%	1%	33%

(1) ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. ESTIMATES ARE AS OF DECEMBER 1983. SAMPLE IS 4263 INSTRUMENT SYSTEMS.

NOTE: SUBCATEGORY NUMBERS AND PERCENTAGES MAY NOT SUM EXACTLY TO TOTAL BECAUSE OF ROUNDING. ESTIMATED TOTALS MAY VARY SLIGHTLY FROM TABLE TO TABLE.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 10. AGGREGATE PURCHASE PRICE OF ACADEMIC RESEARCH INSTRUMENT SYSTEMS IN NATIONAL STOCK, BY SYSTEM RESEARCH STATUS AND BY FIELD [1]

[DOLLARS IN MILLIONS]

	AGGREGATE PURCHASE PRICE AND PERCENT OF PRICE — SYSTEM RESEARCH STATUS				
		IN RESEARCH USE		NOT YET IN RESEARCH USE	NO LONGER IN RESEARCH USE
	TOTAL	STATE-OF-THE-ART	OTHER		
TOTAL, SELECTED FIELDS	$1630.78	$372.38	$942.65	$31.23	$284.52
	100%	23%	58%	2%	17%
FIELD OF RESEARCH					
ENGINEERING	333.61	74.56	184.96	12.06	62.03
	100%	22%	55%	4%	19%
AGRICULTURAL SCIENCES	42.60	11.23	26.28	.41	4.67
	100%	26%	62%	1%	11%
BIOLOGICAL SCIENCES, TOTAL	471.29	124.24	290.74	4.20	52.11
	100%	26%	62%	1%	11%
GRADUATE SCHOOLS	186.27	50.04	115.60	1.73	18.91
	100%	27%	62%	1%	10%
MEDICAL SCHOOLS	285.02	74.20	175.15	2.47	33.20
	100%	26%	61%	1%	12%
COMPUTER SCIENCE	60.03	10.70	40.01	3.14	6.18
	100%	18%	67%	5%	10%
ENVIRONMENTAL SCIENCES	126.23	34.63	75.02	2.21	14.37
	100%	27%	59%	2%	11%
MATERIALS SCIENCE	37.12	12.11	22.36	1.09	1.57
	100%	33%	60%	3%	4%
PHYSICAL SCIENCES	481.88	100.29	291.10	5.61	84.89
	100%	21%	60%	1%	18%
INTERDISCIPLINARY, N.E.C.	78.02	4.62	12.19	2.50	58.71
	100%	6%	16%	3%	75%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. FOR PHASE II FIELDS (AGRICULTURAL, BIOLOGICAL AND ENVIRONMENTAL SCIENCES), ESTIMATES ARE AS OF DECEMBER 1983. FOR ALL OTHER FIELDS, ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 8704 INSTRUMENT SYSTEMS.

NOTE: SUBCATEGORY NUMBERS AND PERCENTAGES MAY NOT SUM EXACTLY TO TOTAL BECAUSE OF ROUNDING. ESTIMATED TOTALS MAY VARY SLIGHTLY FROM TABLE TO TABLE.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 10A. AGGREGATE PURCHASE PRICE OF ACADEMIC RESEARCH INSTRUMENT SYSTEMS IN NATIONAL STOCK, BY SYSTEM RESEARCH STATUS AND BY PHYSICAL SCIENCES AND ENGINEERING SUBFIELD [1]

(DOLLARS IN MILLIONS)

	AGGREGATE PURCHASE PRICE AND PERCENT OF PRICE — SYSTEM RESEARCH STATUS				
		IN RESEARCH USE		NOT YET IN RESEARCH USE	NO LONGER IN RESEARCH USE
	TOTAL	STATE-OF-THE-ART	OTHER		
PHYSICAL SCIENCES AND ENGINEERING					
PHYSICAL SCIENCES, TOTAL	$481.88	$100.29	$291.10	$5.61	$84.89
	100%	21%	60%	1%	18%
CHEMISTRY	254.56	49.20	162.05	2.27	41.04
	100%	19%	64%	1%	16%
PHYSICS AND ASTRONOMY	227.32	51.09	129.05	3.34	43.84
	100%	22%	57%	1%	19%
ENGINEERING, TOTAL	333.61	74.56	184.96	12.06	62.03
	100%	22%	55%	4%	19%
CHEMICAL	27.39	7.07	15.62	.47	4.24
	100%	26%	57%	2%	15%
CIVIL	22.29	4.34	9.73	4.14	4.08
	100%	19%	44%	19%	18%
ELECTRICAL	82.68	20.52	42.12	2.26	17.77
	100%	25%	51%	3%	21%
MECHANICAL	67.09	10.46	39.90	1.91	14.82
	100%	16%	59%	3%	22%
METALLURGICAL/MATERIALS	46.35	10.34	31.86	.88	3.28
	100%	22%	69%	2%	7%
OTHER, N.E.C.	87.81	21.83	45.73	2.41	17.85
	100%	25%	52%	3%	20%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES IN THE NATION. ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 3232 INSTRUMENT SYSTEMS.

NOTE: SUBCATEGORY NUMBERS AND PERCENTAGES MAY NOT SUM EXACTLY TO TOTAL BECAUSE OF ROUNDING. ESTIMATED TOTALS MAY VARY SLIGHTLY FROM TABLE TO TABLE.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 108. AGGREGATE PURCHASE PRICE OF ACADEMIC RESEARCH INSTRUMENT SYSTEMS IN NATIONAL STOCK, BY SYSTEM RESEARCH STATUS AND BY AGRICULTURAL AND BIOLOGICAL SCIENCES SUBFIELD [1]

[DOLLARS IN MILLIONS]

	AGGREGATE PURCHASE PRICE AND PERCENT OF PRICE — SYSTEM RESEARCH STATUS				
		IN RESEARCH USE		NOT YET IN RESEARCH USE	NO LONGER IN RESEARCH USE
	TOTAL	STATE-OF-THE-ART	OTHER		
AGRICULTURAL AND BIOLOGICAL SCIENCES					
AGRICULTURAL SCIENCES, TOTAL	$42.60	$11.23	$26.28	$.41	$4.67
	100%	26%	62%	1%	11%
AGRONOMIC SCIENCES	27.41	8.10	16.31	.12	2.88
	100%	30%	60%	-	10%
ANIMAL SCIENCES	9.92	2.22	6.69	.23	.78
	100%	22%	67%	2%	8%
NATURAL RESOURCE MGMT	5.27	.91	3.29	.06	1.01
	100%	17%	62%	1%	19%
BIOLOGICAL SCIENCES, TOTAL	471.29	124.24	290.74	4.20	52.11
	100%	26%	62%	1%	11%
ANATOMY	18.31	4.74	10.95	0	2.63
	100%	26%	60%	-	14%
BIOCHEMISTRY	97.39	23.52	66.95	.53	6.39
	100%	24%	69%	1%	7%
BOTANY	12.08	4.28	7.23	0	.58
	100%	35%	60%	-	5%
FOOD AND NUTRITION	10.19	2.26	6.32	.50	1.11
	100%	22%	62%	5%	11%
MICROBIOLOGY/IMMUNOLOGY	35.78	8.49	23.49	.16	3.64
	100%	24%	66%	-	10%
MOLECULAR/CELLULAR BIOLOGY AND GENETICS	81.87	33.23	46.51	0	2.14
	100%	41%	57%	-	3%
PATHOLOGY	31.04	5.83	18.91	.30	5.80
	100%	19%	61%	2%	19%
PHARMACOLOGY/TOXICOLOGY	44.91	9.01	27.96	.93	7.00
	100%	20%	62%	2%	16%
PHYSIOLOGY/BIOPHYSICS	68.63	17.19	44.08	.88	6.48
	100%	25%	64%	1%	9%
ZOOLOGY/ENTOMOLOGY	13.18	3.78	7.75	.06	1.60
	100%	29%	59%	-	12%
BIOLOGY, GENERAL AND N.E.C.	57.90	11.93	30.59	.64	14.75
	100%	21%	53%	1%	25%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. ESTIMATES ARE AS OF DECEMBER 1983. SAMPLE IS 4263 INSTRUMENT SYSTEMS.

NOTE: SUBCATEGORY NUMBERS AND PERCENTAGES MAY NOT SUM EXACTLY TO TOTAL BECAUSE OF ROUNDING. ESTIMATED TOTALS MAY VARY SLIGHTLY FROM TABLE TO TABLE.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE II. NUMBER AND AGGREGATE COST/VALUE OF ACADEMIC RESEARCH INSTRUMENT SYSTEMS IN ACTIVE RESEARCH USE, BY FIELD (1)

(DOLLARS IN MILLIONS)

	NUMBER OF SYSTEMS	INDEX OF AGGREGATE COST/VALUE (2)			
		PURCHASE PRICE	ACQUISITION COST	REPLACEMENT VALUE	1982 COST-EQUIVALENT
TOTAL, SELECTED FIELDS	36474	$1315	$1237	$1862	$1973
FIELD OF RESEARCH					
ENGINEERING	6810	260	231	401	371
AGRICULTURAL SCIENCES	1653	38	37	52	53
BIOLOGICAL SCIENCES	15103	415	405	583	616
GRADUATE SCHOOLS	6393	166	162	239	247
MEDICAL SCHOOLS	8709	249	243	344	369
COMPUTER SCIENCE	878	51	47	54	60
ENVIRONMENTAL SCIENCES	2126	110	96	149	153
MATERIALS SCIENCE	650	34	34	66	58
PHYSICAL SCIENCES	8801	391	371	530	636
INTERDISCIPLINARY, N.E.C.	454	17	17	27	26

(1) ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. FOR PHASE II FIELDS (AGRICULTURAL, BIOLOGICAL AND ENVIRONMENTAL SCIENCES), ESTIMATES ARE AS OF DECEMBER 1983. FOR ALL OTHER FIELDS, ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 7013 INSTRUMENT SYSTEMS.

(2) SEE TECHNICAL NOTES FOR DEFINITIONS OF THESE STATISTICS.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 11A. NUMBER AND AGGREGATE COST/VALUE OF ACADEMIC RESEARCH INSTRUMENT SYSTEMS IN ACTIVE RESEARCH USE, BY PHYSICAL SCIENCES AND ENGINEERING SUBFIELD [1]

[DOLLARS IN MILLIONS]

	NUMBER OF SYSTEMS	INDEX OF AGGREGATE COST/VALUE [2]			
		PURCHASE PRICE	ACQUISITION COST	REPLACEMENT VALUE	1982 COST-EQUIVALENT
PHYSICAL SCIENCES AND ENGINEERING					
PHYSICAL SCIENCES, TOTAL	8801	$391	$371	$530	$636
CHEMISTRY	4861	211	202	282	331
PHYSICS AND ASTRONOMY	3940	180	169	248	305
ENGINEERING, TOTAL	6810	260	231	401	371
CHEMICAL	676	23	22	25	31
CIVIL	395	14	14	20	22
ELECTRICAL	1516	63	52	86	83
MECHANICAL	1343	50	47	89	66
METALLURGICAL/MATERIALS	1098	42	39	70	64
OTHER, N.E.C.	1783	68	57	110	106

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES IN THE NATION. ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 2446 INSTRUMENT SYSTEMS.

[2] SEE TECHNICAL NOTES FOR DEFINITIONS OF THESE STATISTICS.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 113. NUMBER AND AGGREGATE COST/VALUE OF ACADEMIC RESEARCH INSTRUMENT SYSTEMS IN ACTIVE RESEARCH USE, BY AGRICULTURAL AND BIOLOGICAL SCIENCES SUBFIELD [1]

(DOLLARS IN MILLIONS)

	NUMBER OF SYSTEMS	INDEX OF AGGREGATE COST/VALUE [2]			
		PURCHASE PRICE	ACQUISITION COST	REPLACEMENT VALUE	1982 COST-EQUIVALENT
AGRICULTURAL AND BIOLOGICAL SCIENCES					
AGRICULTURAL SCIENCES, TOTAL	1633	938	937	952	953
AGRONOMIC SCIENCES	1042	24	24	25	24
ANIMAL SCIENCES	429	9	9	12	13
NATURAL RESOURCE MGMT	181	4	4	5	6
BIOLOGICAL SCIENCES, TOTAL	15103	415	405	383	416
ANATOMY	481	16	15	28	27
BIOCHEMISTRY	3703	90	88	118	134
BOTANY	438	12	11	16	16
FOOD AND NUTRITION	389	9	8	11	12
MICROBIOLOGY/IMMUNOLOGY	1295	32	31	49	50
MOLECULAR/CELLULAR BIOLOGY AND GENETICS	2744	80	78	129	116
PATHOLOGY	760	25	24	39	40
PHARMACOLOGY/TOXICOLOGY	1640	37	36	46	52
PHYSIOLOGY/BIOPHYSICS	2006	61	58	74	88
ZOOLOGY/ENTOMOLOGY	424	12	11	15	17
BIOLOGY, GENERAL AND N.E.C.	1275	43	43	66	66

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. FOR PHASE II FIELDS (AGRICULTURAL, BIOLOGICAL AND ENVIRONMENTAL SCIENCES), ESTIMATES ARE AS OF DECEMBER 1983. FOR ALL OTHER FIELDS, ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 2048 INSTRUMENT SYSTEMS.

[2] SEE TECHNICAL NOTES FOR DEFINITIONS OF THESE STATISTICS.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 12. MEAN AMOUNT OF IN-USE ACADEMIC RESEARCH EQUIPMENT PER INSTITUTION, BY UNIVERSITY CONTROL AND BY FIELD [1]

(DOLLARS IN THOUSANDS)

	UNIVERSITY CONTROL					
	TOTAL		PRIVATE		PUBLIC	
	MEAN NUMBER OF SYSTEMS	MEAN AGGREGATE PURCHASE PRICE	MEAN NUMBER OF SYSTEMS	MEAN AGGREGATE PURCHASE PRICE	MEAN NUMBER OF SYSTEMS	MEAN AGGREGATE PURCHASE PRICE
TOTAL, SELECTED FIELDS	177	96788	169	97020	181	96669
FIELD OF RESEARCH						
ENGINEERING	43	1653	41	1809	44	1573
AGRICULTURAL SCIENCES	11	239	1	22	15	349
BIOLOGICAL SCIENCES, TOTAL	61	1667	56	1764	63	1628
GRADUATE SCHOOLS	41	1053	38	1069	42	1048
MEDICAL SCHOOLS	95	2710	80	2639	104	2713
COMPUYER SCIENCE	6	323	9	396	4	184
ENVIRONMENTAL SCIENCES	14	698	11	581	15	758
MATERIALS SCIENCE	4	220	8	389	2	133
PHYSICAL SCIENCES	56	2493	59	2508	55	2485
INTERDISCIPLINARY, N.E.C.	3	107	1	43	4	139

[1] ESTIMATES FOR BIOLOGICAL SCIENCES IN MEDICAL SCHOOLS HAVE A BASE OF 92 MEDICAL SCHOOLS (40 PRIVATE, 52 PUBLIC). ESTIMATES FOR "BIOLOGICAL SCIENCES, TOTAL" HAVE A BASE OF 249 INSTITUTIONS (92 MEDICAL SCHOOLS AND 157 UNIVERSITIES). ALL OTHER ESTIMATES ARE BASED ON 157 UNIVERSITIES (53 PRIVATE, 104 PUBLIC). FOR PHASE II FIELDS (AGRICULTURAL, BIOLOGICAL AND ENVIRONMENTAL SCIENCES), ESTIMATES ARE AS OF DECEMBER 1983. FOR ALL OTHER FIELDS, ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 8704 INSTRUMENT SYSTEMS.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 12A. MEAN AMOUNT OF IN-USE ACADEMIC RESEARCH EQUIPMENT PER INSTITUTION, BY UNIVERSITY CONTROL AND BY PHYSICAL SCIENCES AND ENGINEERING SUBFIELD [1]

[DOLLARS IN THOUSANDS]

	UNIVERSITY CONTROL					
	TOTAL		PRIVATE		PUBLIC	
	MEAN NUMBER OF SYSTEMS	MEAN AGGREGATE PURCHASE PRICE	MEAN NUMBER OF SYSTEMS	MEAN AGGREGATE PURCHASE PRICE	MEAN NUMBER OF SYSTEMS	MEAN AGGREGATE PURCHASE PRICE
PHYSICAL SCIENCES AND ENGINEERING						
PHYSICAL SCIENCES, TOTAL	56	92493	59	92508	55	92483
CHEMISTRY	31	1346	29	1307	32	1365
PHYSICS AND ASTRONOMY	25	1147	30	1202	23	1109
ENGINEERING, TOTAL	43	1653	41	1809	44	1573
CHEMICAL	4	145	5	207	4	113
CIVIL	3	90	1	47	3	111
ELECTRICAL	10	399	8	454	10	371
MECHANICAL	9	321	15	518	6	239
METALLUGICAL/MATERIALS	7	269	6	250	7	279
OTHER, N.E.C.	11	430	6	333	14	480

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES IN THE NATION. ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 3232 INSTRUMENT SYSTEMS.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 129. MEAN AMOUNT OF IN-USE ACADEMIC RESEARCH EQUIPMENT PER INSTITUTION, BY UNIVERSITY CONTROL AND BY AGRICULTURAL AND BIOLOGICAL SCIENCES SUBFIELD [1]

(DOLLARS IN THOUSANDS)

	TOTAL		UNIVERSITY CONTROL			
			PRIVATE		PUBLIC	
	MEAN NUMBER OF SYSTEMS	MEAN AGGREGATE PURCHASE PRICE	MEAN NUMBER OF SYSTEMS	MEAN AGGREGATE PURCHASE PRICE	MEAN NUMBER OF SYSTEMS	MEAN AGGREGATE PURCHASE PRICE
AGRICULTURAL AND BIOLOGICAL SCIENCES						
AGRICULTURAL SCIENCES, TOTAL	11	6239	1	822	15	6349
AGRONOMIC SCIENCES	7	155	1	17	10	226
ANIMAL SCIENCES	3	57	-	6	4	84
NATURAL RESOURCE MGMT	1	27	-	2	2	39
BIOLOGICAL SCIENCES, TOTAL	61	1667	56	1744	63	1620
ANATOMY	2	63	1	63	2	63
BIOCHEMISTRY	15	363	12	323	16	388
BOTANY	2	46	1	28	2	57
FOOD AND NUTRITION	2	34	1	12	2	48
MICROBIOLOGY/IMMUNOLOGY	5	128	4	76	6	159
MOLECULAR/CELLULAR BIOLOGY AND GENETICS	11	330	13	462	9	235
PATHOLOGY	3	99	3	93	3	103
PHARMACOLOGY/TOXICOLOGY	7	148	5	132	7	158
PHYSIOLOGY/BIOPHYSICS	8	246	8	336	8	193
ZOOLOGY/ENTOMOLOGY	4	46	2	59	2	39
BIOLOGY, GENERAL AND N.E.C.	5	171	4	160	6	177

[1] ALL ESTIMATES FOR AGRICULTURAL SCIENCES ARE BASED ON 157 UNIVERSITIES (53 PRIVATE, 104 PUBLIC). ESTIMATES FOR ALL BIOLOGICAL SCIENCE SUBFIELDS ARE BASED ON 249 UNIVERSITIES AND MEDICAL SCHOOLS (93 PRIVATE, 156 PUBLIC). ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 4263 INSTRUMENT SYSTEMS.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 13. INSTRUMENTATION-RELATED EXPENDITURES IN ACADEMIC DEPARTMENTS AND FACILITIES, BY FIELD [1]

[DOLLARS IN MILLIONS]

	EXPENDITURES AND PERCENT OF EXPENDITURES			
	TOTAL	PURCHASE OF RESEARCH EQUIPMENT $500 OR MORE	PURCHASE OF RESEARCH-RELATED COMPUTER SERVICES	MAINTENANCE/ REPAIR OF RESEARCH EQUIPMENT
TOTAL, SELECTED FIELDS	$640.6 100%	$414.5 65%	$121.3 19%	$104.8 16%
FIELD OF RESEARCH				
ENGINEERING	146.6 100%	86.5 59%	41.3 28%	18.8 13%
AGRICULTURAL SCIENCES	40.6 100%	28.4 70%	7.3 18%	5.0 12%
BIOLOGICAL SCIENCES, TOTAL	192.3 100%	132.4 69%	27.8 14%	32.2 17%
GRADUATE SCHOOLS	79.0 100%	51.8 66%	13.2 17%	14.0 18%
MEDICAL SCHOOLS	113.3 100%	80.5 71%	14.5 13%	18.3 16%
COMPUTER SCIENCE	29.7 100%	19.7 66%	3.6 12%	6.4 21%
ENVIRONMENTAL SCIENCES	49.6 100%	33.4 67%	6.9 14%	9.3 19%
MATERIALS SCIENCE	12.4 100%	9.6 77%	.6 4%	2.3 18%
PHYSICAL SCIENCES	151.3 100%	91.2 60%	31.9 21%	28.2 19%
INTERDISCIPLINARY, N.E.C.	17.8 100%	13.3 75%	1.9 11%	2.6 14%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. FOR PHASE II FIELDS (AGRICULTURAL, BIOLOGICAL AND ENVIRONMENTAL SCIENCES), ESTIMATES REFER TO EXPENDITURES IN FY 1983. FOR PHASE I FIELDS, ESTIMATES ARE OF EXPENDITURES IN FY 1982. SAMPLE IS 912 DEPARTMENTS AND FACILITIES.

NOTE: SUBCATEGORY NUMBERS AND PERCENTAGES MAY NOT SUM EXACTLY TO TOTAL BECAUSE OF ROUNDING. ESTIMATED TOTALS MAY VARY SLIGHTLY FROM TABLE TO TABLE.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 13A. INSTRUMENTATION-RELATED EXPENDITURES IN ACADEMIC DEPARTMENTS AND FACILITIES, BY PHYSICAL SCIENCES AND ENGINEERING SUBFIELD [1]

[DOLLARS IN MILLIONS]

	EXPENDITURES AND PERCENT OF EXPENDITURES			
	TOTAL	PURCHASE OF RESEARCH EQUIPMENT $500 OR MORE	PURCHASE OF RESEARCH-RELATED COMPUTER SERVICES	MAINTENANCE/ REPAIR OF RESEARCH EQUIPMENT
PHYSICAL SCIENCES AND ENGINEERING				
PHYSICAL SCIENCES, TOTAL	$151.3	$91.2	$31.9	$28.2
	100%	60%	21%	19%
CHEMISTRY	71.9	38.9	21.3	11.7
	100%	54%	30%	16%
PHYSICS AND ASTRONOMY	79.5	52.3	10.7	16.5
	100%	66%	13%	21%
ENGINEERING, TOTAL	146.6	86.5	41.3	18.8
	100%	59%	28%	13%
CHEMICAL	20.9	10.3	7.8	2.8
	100%	49%	38%	13%
CIVIL	16.8	10.6	4.7	1.5
	100%	63%	28%	9%
ELECTRICAL	46.2	31.4	10.3	4.6
	100%	68%	22%	10%
MECHANICAL	19.5	7.6	8.9	2.9
	100%	39%	46%	15%
METALLURGICAL/MATERIALS	9.9	7.4	.7	1.8
	100%	75%	7%	18%
OTHER, N.E.C.	33.4	19.2	8.9	5.2
	100%	58%	27%	16%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES IN THE NATION. ESTIMATES ARE OF EXPENDITURES IN FY 1982. SAMPLE IS 322 DEPARTMENTS AND FACILITIES.

NOTE: SUBCATEGORY NUMBERS AND PERCENTAGES MAY NOT SUM EXACTLY TO TOTAL BECAUSE OF ROUNDING. ESTIMATED TOTALS MAY VARY SLIGHTLY FROM TABLE TO TABLE.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 13B. INSTRUMENTATION-RELATED EXPENDITURES IN ACADEMIC DEPARTMENTS AND FACILITIES, BY AGRICULTURAL AND BIOLOGICAL SCIENCES SUBFIELD [1]

[DOLLARS IN MILLIONS]

	EXPENDITURES AND PERCENT OF EXPENDITURES			
	TOTAL	PURCHASE OF RESEARCH EQUIPMENT $500 OR MORE	PURCHASE OF RESEARCH-RELATED COMPUTER SERVICES	MAINTENANCE/ REPAIR OF RESEARCH EQUIPMENT
AGRICULTURAL AND BIOLOGICAL SCIENCES				
AGRICULTURAL SCIENCES, TOTAL	$40.6	$28.4	$7.3	$5.0
	100%	70%	18%	12%
AGRONOMIC SCIENCES	29.0	21.5	4.4	3.1
	100%	74%	15%	11%
ANIMAL SCIENCES	5.3	3.7	.9	.7
	100%	70%	17%	13%
NATURAL RESOURCE MGMT	6.3	3.2	2.0	1.1
	100%	51%	31%	18%
BIOLOGICAL SCIENCES, TOTAL	192.3	132.4	27.8	32.2
	100%	69%	14%	17%
ANATOMY	12.7	9.7	.3	2.6
	100%	77%	2%	21%
BIOCHEMISTRY	24.4	19.1	1.1	4.3
	100%	78%	5%	17%
BOTANY	3.9	3.0	.3	.6
	100%	77%	7%	16%
FOOD AND NUTRITION	6.1	3.8	1.5	.8
	100%	62%	25%	14%
MICROBIOLOGY/IMMUNOLOGY	13.8	10.7	.4	2.6
	100%	78%	3%	19%
MOLECULAR/CELLULAR BIOLOGY AND GENETICS	28.9	18.4	7.9	2.6
	100%	64%	27%	9%
PATHOLOGY	13.1	8.0	2.7	2.4
	100%	61%	21%	18%
PHARMACOLOGY/TOXICOLOGY	18.8	13.3	2.7	2.8
	100%	71%	14%	15%
PHYSIOLOGY/BIOPHYSICS	24.9	17.8	2.7	4.4
	100%	71%	11%	18%
ZOOLOGY/ENTOMOLOGY	7.0	4.9	.8	1.3
	100%	70%	11%	18%
BIOLOGY, GENERAL AND N.E.C.	38.7	23.6	7.3	7.7
	100%	61%	19%	20%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. ESTIMATES REFER TO EXPENDITURES IN FY 1983. SAMPLE IS 454 DEPARTMENTS AND FACILITIES.

NOTE: SUBCATEGORY NUMBERS AND PERCENTAGES MAY NOT SUM EXACTLY TO TOTAL BECAUSE OF ROUNDING. ESTIMATED TOTALS MAY VARY SLIGHTLY FROM TABLE TO TABLE.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 14. DEPARTMENT/FACILITY EXPENDITURES FOR PURCHASE OF NONEXPENDABLE ACADEMIC RESEARCH EQUIPMENT IN CURRENT AND NEXT FISCAL YEAR, BY FIELD [1]

[DOLLARS IN MILLIONS]

	EXPENDITURES FOR PURCHASE OF SCIENTIFIC RESEARCH EQUIPMENT [2]		
	CURRENT FISCAL YEAR (ACTUAL)	NEXT FISCAL YEAR (ANTICIPATED)	PERCENTAGE INCREASE OR DECREASE
TOTAL, SELECTED FIELDS	$339.6	$347.8	+2%
FIELD OF RESEARCH			
ENGINEERING	76.8	82.6	+8%
AGRICULTURAL SCIENCES	25.3	17.4	-31%
BIOLOGICAL SCIENCES, TOTAL	111.6	92.6	-17%
GRADUATE SCHOOLS	45.0	49.2	+9%
MEDICAL SCHOOLS	66.6	43.4	-35%
COMPUTER SCIENCE	16.7	27.8	+66%
ENVIRONMENTAL SCIENCES	23.4	34.1	+46%
MATERIALS SCIENCE	6.9	7.9	+14%
PHYSICAL SCIENCES	69.3	74.9	+8%
INTERDISCIPLINARY, N.E.C.	9.7	10.5	+8%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. FOR PHASE II FIELDS (AGRICULTURAL, BIOLOGICAL AND ENVIRONMENTAL SCIENCES), ESTIMATES REFER TO EXPENDITURES IN FY 1983. FOR PHASE I FIELDS, ESTIMATES ARE OF EXPENDITURES IN FY 1982. SAMPLE IS 912 DEPARTMENTS AND FACILITIES.

[2] ESTIMATES ARE BASED ON DEPARTMENTS THAT PROVIDED DATA FOR BOTH CURRENT AND NEXT FISCAL YEAR, WITH NO ADJUSTMENT FOR ITEM NONRESPONSE BY OTHER DEPARTMENTS. CONSEQUENTLY, EXPENDITURE VALUES ARE LOW IN ABSOLUTE TERMS BUT ARE MEANINGFUL IN RELATIVE (CURRENT VS NEXT YEAR) TERMS.

NOTE: SUBCATEGORY NUMBERS AND PERCENTAGES MAY NOT SUM EXACTLY TO TOTAL BECAUSE OF ROUNDING. ESTIMATED TOTALS MAY VARY SLIGHTLY FROM TABLE TO TABLE.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 14A. DEPARTMENT/FACILITY EXPENDITURES FOR PURCHASE OF NONEXPENDABLE ACADEMIC RESEARCH EQUIPMENT IN CURRENT AND NEXT FISCAL YEAR, BY PHYSICAL SCIENCES AND ENGINEERING SUBFIELD [1]

[DOLLARS IN MILLIONS]

	EXPENDITURES FOR PURCHASE OF SCIENTIFIC RESEARCH EQUIPMENT [2]		
	CURRENT FISCAL YEAR (ACTUAL)	NEXT FISCAL YEAR (ANTICIPATED)	PERCENTAGE INCREASE OR DECREASE
PHYSICAL SCIENCES AND ENGINEERING			
PHYSICAL SCIENCES, TOTAL	$69.3	$74.9	+8%
CHEMISTRY	29.2	33.0	+13%
PHYSICS AND ASTRONOMY	40.1	41.9	+1%
ENGINEERING, TOTAL	76.8	82.6	+8%
CHEMICAL	9.3	8.7	-6%
CIVIL	10.5	9.8	-7%
ELECTRICAL	25.7	26.9	+5%
MECHANICAL	7.3	8.5	+16%
METALLURGICAL/MATERIALS	5.6	7.0	+25%
OTHER, N.E.C.	18.4	21.7	+18%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES IN THE NATION. CURRENT YEAR ESTIMATES ARE OF EXPENDITURES IN FY 1982. SAMPLE IS 322 DEPARTMENTS AND FACILITIES.

[2] ESTIMATES ARE BASED ON DEPARTMENTS THAT PROVIDED DATA FOR BOTH CURRENT AND NEXT FISCAL YEAR, WITH NO ADJUSTMENT FOR ITEM NONRESPONSE BY OTHER DEPARTMENTS. CONSEQUENTLY, EXPENDITURE VALUES ARE LOW IN ABSOLUTE TERMS BUT ARE MEANINGFUL IN RELATIVE (CURRENT VS NEXT YEAR) TERMS.

NOTE: SUBCATEGORY NUMBERS AND PERCENTAGES MAY NOT SUM EXACTLY TO TOTAL BECAUSE OF ROUNDING. ESTIMATED TOTALS MAY VARY SLIGHTLY FROM TABLE TO TABLE.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 14B. DEPARTMENT/FACILITY EXPENDITURES FOR PURCHASE OF NONEXPENDABLE ACADEMIC RESEARCH EQUIPMENT IN CURRENT AND NEXT FISCAL YEAR, BY AGRICULTURAL AND BIOLOGICAL SCIENCES SUBFIELD [1]

[DOLLARS IN MILLIONS]

	EXPENDITURES FOR PURCHASE OF SCIENTIFIC RESEARCH EQUIPMENT [2]		
	CURRENT FISCAL YEAR (ACTUAL)	NEXT FISCAL YEAR (ANTICIPATED)	PERCENTAGE INCREASE OR DECREASE
AGRICULTURAL AND BIOLOGICAL SCIENCES			
AGRICULTURAL SCIENCES, TOTAL	$24.0	$17.3	-28%
AGRONOMIC SCIENCES	18.5	11.9	-36%
ANIMAL SCIENCES	2.4	2.5	+4%
NATURAL RESOURCE MGMT	3.1	2.8	-10%
BIOLOGICAL SCIENCES, TOTAL	108.5	92.6	-15%
ANATOMY	8.5	6.1	-29%
BIOCHEMISTRY	14.7	17.1	+16%
BOTANY	1.8	1.3	-28%
FOOD AND NUTRITION	3.3	3.2	-3%
MICROBIOLOGY/IMMUNOLOGY	8.8	12.8	+45%
MOLECULAR/CELLULAR BIOLOGY AND GENETICS	18.2	7.1	-61%
PATHOLOGY	5.7	4.1	-28%
PHARMACOLOGY/TOXICOLOGY	6.2	4.9	-21%
PHYSIOLOGY/BIOPHYSICS	16.9	11.4	-33%
ZOOLOGY/ENTOMOLOGY	4.2	5.8	+38%
BIOLOGY, GENERAL AND N.E.C.	20.2	18.6	-8%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. CURRENT YEAR ESTIMATES REFER TO EXPENDITURES IN FY 1983. SAMPLE IS 434 DEPARTMENTS AND FACILITIES.

[2] ESTIMATES ARE BASED ON DEPARTMENTS THAT PROVIDED DATA FOR BOTH CURRENT AND NEXT FISCAL YEAR, WITH NO ADJUSTMENT FOR ITEM NONRESPONSE BY OTHER DEPARTMENTS. CONSEQUENTLY, EXPENDITURE VALUES ARE LOW IN ABSOLUTE TERMS BUT ARE MEANINGFUL IN RELATIVE (CURRENT VS NEXT YEAR) TERMS.

NOTE: SUBCATEGORY NUMBERS AND PERCENTAGES MAY NOT SUM EXACTLY TO TOTAL BECAUSE OF ROUNDING. ESTIMATED TOTALS MAY VARY SLIGHTLY FROM TABLE TO TABLE.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 15. MEAN ANNUAL EXPENDITURES FOR PURCHASE OF RESEARCH EQUIPMENT, BY UNIT AND BY FIELD [1]

[DOLLARS IN THOUSANDS]

	MEAN ANNUAL EXPENDITURES FOR RESEARCH EQUIPMENT [2]		
	PER UNIVERSITY	PER DEPARTMENT/ FACILITY	PER FTE FACULTY-LEVEL RESEARCHER [3]
TOTAL, SELECTED FIELDS	$2127.3 [4]	$146.4	$8.2
FIELD OF RESEARCH			
ENGINEERING	550.9	133.7	8.4
AGRICULTURAL SCIENCES	180.9	115.7	4.3
BIOLOGICAL SCIENCES, TOTAL	531.5	113.8	7.5
GRADUATE SCHOOLS	330.0	91.9	5.8
MEDICAL SCHOOLS	875.4	134.2	9.1
COMPUTER SCIENCE	125.7	221.8	12.7
ENVIRONMENTAL SCIENCES	212.9	139.8	8.0
MATERIALS SCIENCE	61.0	504.4	10.0
PHYSICAL SCIENCES	581.1	251.3	11.3
INTERDISCIPLINARY, N.E.C.	84.7	203.4	5.2

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. FOR PHASE II FIELDS (AGRICULTURAL, BIOLOGICAL AND ENVIRONMENTAL SCIENCES), ESTIMATES REFER TO EXPENDITURES IN FY 1983. FOR PHASE I FIELDS, ESTIMATES ARE OF EXPENDITURES IN FY 1982. SAMPLE IS 912 DEPARTMENTS AND FACILITIES.

[2] ESTIMATES REFER TO EXPENDITURES FOR NONEXPENDABLE, TANGIBLE PROPERTY OR SOFTWARE HAVING A USEFUL LIFE OF MORE THAN TWO YEARS AND AN ACQUISITION COST OF $500 OR MORE, USED WHOLLY OR IN PART FOR SCIENTIFIC RESEARCH.

[3] FTE = FULL-TIME EQUIVALENT

[4] ESTIMATE DOES NOT INCLUDE MEDICAL SCHOOLS

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 15A. MEAN ANNUAL EXPENDITURES FOR PURCHASE OF RESEARCH EQUIPMENT, BY UNIT AND BY PHYSICAL SCIENCES AND ENGINEERING SUBFIELD [1]

[DOLLARS IN THOUSANDS]

	MEAN FY 1982 EXPENDITURES FOR RESEARCH EQUIPMENT [2]		
	PER UNIVERSITY	PER DEPARTMENT/ FACILITY	PER FTE FACULTY-LEVEL RESEARCHER [3]
PHYSICAL SCIENCES AND ENGINEERING			
PHYSICAL SCIENCES, TOTAL	$581.0	$251.3	$11.3
CHEMISTRY	248.0	223.3	12.5
PHYSICS AND ASTRONOMY	333.0	277.0	10.4
ENGINEERING, TOTAL	550.9	133.7	8.4
CHEMICAL	65.3	105.6	10.2
CIVIL	67.4	86.1	5.9
ELECTRICAL	199.7	385.8	16.7
MECHANICAL	48.7	90.0	4.5
METALLURGICAL/MATERIALS	47.3	125.6	9.7
OTHER, N.E.C.	122.5	93.2	6.1

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES THE NATION. SAMPLE IS 322 DEPARTMENTS AND FACILITIES.

[2] ESTIMATES REFER TO EXPENDITURES FOR NONEXPENDABLE, TANGIBLE PROPERTY OR SOFTWARE HAVING A USEFUL LIFE OF MORE THAN TWO YEARS AND AN ACQUISITION COST OF $500 OR MORE, USED WHOLLY OR IN PART FOR SCIENTIFIC RESEARCH.

[3] FTE = FULL-TIME EQUIVALENT

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 13B. MEAN ANNUAL EXPENDITURES FOR PURCHASE OF RESEARCH EQUIPMENT, BY UNIT AND BY AGRICULTURAL AND BIOLOGICAL SCIENCES SUBFIELD [1]

[DOLLARS IN THOUSANDS]

	MEAN FY 1983 EXPENDITURES FOR RESEARCH EQUIPMENT [2]		
	PER UNIVERSITY	PER DEPARTMENT/ FACILITY	PER FTE FACULTY-LEVEL RESEARCHER [3]
AGRICULTURAL AND BIOLOGICAL SCIENCES			
AGRICULTURAL SCIENCES, TOTAL	$180.9	$115.7	$4.3
AGRONOMIC SCIENCES	136.8	196.8	4.8
ANIMAL SCIENCES	23.6	44.8	3.6
NATURAL RESOURCE MGMT	20.4	59.8	4.1
BIOLOGICAL SCIENCES, TOTAL	531.5	113.8	7.5
ANATOMY	39.1	131.0	7.5
BIOCHEMISTRY	76.5	129.5	8.9
BOTANY	12.1	76.4	5.0
FOOD AND NUTRITION	15.1	71.4	5.7
MICROBIOLOGY/IMMUNOLOGY	43.2	67.2	5.3
MOLECULAR/CELLULAR BIOLOGY AND GENETICS	74.0	248.1	25.2
PATHOLOGY	32.2	91.4	5.1
PHARMACOLOGY/TOXICOLOGY	53.3	123.8	8.5
PHYSIOLOGY/BIOPHYSICS	71.5	133.2	9.8
ZOOLOGY/ENTOMOLOGY	19.7	71.2	4.7
BIOLOGY, GENERAL AND N.E.C.	94.8	108.4	5.1

[1] ESTIMATES FOR AGRICULTURAL SCIENCES ARE BASED ON A UNIVERSE OF 157 INSTITUTIONS (53 PRIVATE, 104 PUBLIC); ESTIMATES FOR BIOLOGICAL SCIENCES HAVE BASE OF 249 INSTITUTIONS (157 UNIVERSITIES PLUS 92 MEDICAL SCHOOLS). SAMPLE IS 454 DEPARTMENTS AND FACILITIES.

[2] ESTIMATES REFER TO EXPENDITURES FOR NONEXPENDABLE, TANGIBLE PROPERTY OR SOFTWARE HAVING A USEFUL LIFE OF MORE THAN TWO YEARS AND AN ACQUISTION COST OF $500 OR MORE, USED WHOLLY OR IN PART FOR SCIENTIFIC RESEARCH.

[3] FTE = FULL-TIME EQUIVALENT

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 16. AGE OF ACADEMIC RESEARCH INSTRUMENT SYSTEMS IN NATIONAL STOCK, BY FIELD [1]

	NUMBER AND PERCENT OF SYSTEMS — SYSTEM AGE (FROM YR OF PURCHASE)[2]			
	TOTAL	1-5 YEARS	6-10 YEARS	OVER 10 YEARS
TOTAL, SELECTED FIELDS	45890	21663	10885	13342
	100%	47%	24%	29%
FIELD OF RESEARCH				
ENGINEERING	9224	4845	1723	2656
	100%	53%	19%	29%
AGRICULTURAL SCIENCES	1950	1028	515	407
	100%	53%	26%	21%
BIOLOGICAL SCIENCES, TOTAL	17545	7768	4965	4812
	100%	44%	28%	27%
GRADUATE SCHOOLS	7250	3431	1854	1965
	100%	47%	26%	27%
MEDICAL SCHOOLS	10295	4337	3111	2847
	100%	42%	30%	28%
COMPUTER SCIENCE	1073	869	87	116
	100%	81%	8%	11%
ENVIRONMENTAL SCIENCES	2664	1412	660	592
	100%	53%	25%	22%
MATERIALS SCIENCE	731	239	113	379
	100%	33%	15%	52%
PHYSICAL SCIENCES	11484	5155	2461	3869
	100%	45%	21%	34%
INTERDISCIPLINARY, N.E.C.	1219	346	361	511
	100%	28%	30%	42%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 137 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. FOR PHASE II FIELDS (AGRICULTURAL, BIOLOGICAL AND ENVIRONMENTAL SCIENCES), ESTIMATES ARE AS OF DECEMBER 1983. FOR ALL OTHER FIELDS, ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 8704 INSTRUMENT SYSTEMS.

[2] FOR PHASE II FIELDS, AGE INTERVALS ARE 1-5 YEARS (1979-83); 6-10 YEARS (1974-78); OVER 10 YEARS (1973 OR BEFORE). FOR PHASE I FIELDS, INTERVALS ARE 1-5 YEARS (1978-82); 6-10 YEARS (1973-77); OVER 10 YEARS (1972 OR BEFORE).

NOTE: SUBCATEGORY NUMBERS AND PERCENTAGES MAY NOT SUM EXACTLY TO TOTAL BECAUSE OF ROUNDING. ESTIMATED TOTALS MAY VARY SLIGHTLY FROM TABLE TO TABLE.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 16A. AGE OF ACADEMIC RESEARCH INSTRUMENT SYSTEMS IN NATIONAL STOCK, BY PHYSICAL SCIENCES AND ENGINEERING SUBFIELD [1]

	NUMBER AND PERCENT OF SYSTEMS — SYSTEM AGE (FROM YR OF PURCHASE) [2]			
	TOTAL	1-5 YEARS	6-10 YEARS	OVER 10 YEARS
PHYSICAL SCIENCES AND ENGINEERING				
PHYSICAL SCIENCES, TOTAL	11484	5155	2461	3869
	100%	45%	21%	34%
CHEMISTRY	6368	3094	1420	1854
	100%	49%	22%	29%
PHYSICS AND ASTRONOMY	5116	2061	1041	2014
	100%	40%	20%	39%
ENGINEERING, TOTAL	9224	4845	1723	2656
	100%	53%	19%	29%
CHEMICAL	847	474	195	178
	100%	56%	23%	21%
CIVIL	616	291	94	232
	100%	47%	15%	38%
ELECTRICAL	2195	1405	359	432
	100%	64%	16%	20%
MECHANICAL	1813	903	234	677
	100%	50%	13%	37%
METALLURGICAL/MATERIALS	1234	731	222	281
	100%	59%	18%	23%
OTHER, N.E.C.	2518	1041	621	956
	100%	41%	25%	34%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES IN THE NATION. ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 3232 INSTRUMENT SYSTEMS.

[2] AGE INTERVALS ARE 1-5 YEARS (1978-82); 6-10 YEARS (1973-77); OVER 10 YEARS (1972 OR BEFORE).

NOTE: SUBCATEGORY NUMBERS AND PERCENTAGES MAY NOT SUM EXACTLY TO TOTAL BECAUSE OF ROUNDING. ESTIMATED TOTALS MAY VARY SLIGHTLY FROM TABLE TO TABLE.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 168. AGE OF ACADEMIC RESEARCH INSTRUMENT SYSTEMS IN NATIONAL STOCK, BY AGRICULTURAL AND BIOLOGICAL SCIENCES SUBFIELD [1]

	NUMBER AND PERCENT OF SYSTEMS — SYSTEM AGE (FROM YR OF PURCHASE) [2]			
	TOTAL	1-5 YEARS	6-10 YEARS	OVER 10 YEARS
AGRICULTURAL AND BIOLOGICAL SCIENCES				
AGRICULTURAL SCIENCES, TOTAL	1950	1028	515	407
	100%	53%	26%	21%
AGRONOMIC SCIENCES	1229	630	367	232
	100%	51%	28%	21%
ANIMAL SCIENCES	485	271	119	94
	100%	56%	25%	19%
NATURAL RESOURCE MGMT	237	126	69	61
	100%	53%	21%	26%
BIOLOGICAL SCIENCES, TOTAL	17545	7768	4965	4812
	100%	44%	28%	27%
ANATOMY	549	217	111	220
	100%	40%	20%	40%
BIOCHEMISTRY	4062	1842	1176	1043
	100%	45%	29%	26%
BOTANY	471	249	112	110
	100%	53%	24%	23%
FOOD AND NUTRITION	441	236	113	92
	100%	53%	26%	21%
MICROBIOLOGY/IMMUNOLOGY	1437	508	516	412
	100%	35%	36%	29%
MOLECULAR/CELLULAR BIOLOGY AND GENETICS	2836	1373	816	647
	100%	48%	29%	23%
PATHOLOGY	999	379	296	323
	100%	38%	30%	32%
PHARMACOLOGY/TOXICOLOGY	1973	863	566	543
	100%	44%	29%	28%
PHYSIOLOGY/BIOPHYSICS	2367	1152	561	654
	100%	49%	24%	28%
ZOOLOGY/ENTOMOLOGY	503	280	101	122
	100%	56%	20%	24%
BIOLOGY, GENERAL AND N.E.C.	1908	668	596	644
	100%	35%	31%	34%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. ESTIMATES ARE AS OF DECEMBER 1983. SAMPLE IS 4263 INSTRUMENT SYSTEMS.

[2] AGE INTERVALS ARE 1-5 YEARS (1979-83); 6-10 YEARS (1974-78); OVER 10 YEARS (1973 OR BEFORE).

NOTE: SUBCATEGORY NUMBERS AND PERCENTAGES MAY NOT SUM EXACTLY TO TOTAL BECAUSE OF ROUNDING. ESTIMATED TOTALS MAY VARY SLIGHTLY FROM TABLE TO TABLE.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 17. PERCENT OF ACADEMIC RESEARCH INSTRUMENT SYSTEMS THAT ARE CLASSIFIED AS STATE-OF-THE-ART, BY PURCHASE PRICE AND BY FIELD (1)

	PERCENT OF SYSTEMS CLASSIFIED AS STATE-OF-THE-ART BY PURCHASE PRICE			
	TOTAL	$10,000-$24,999	$25,000-$74,999	$75,000-$1,000,000
TOTAL, SELECTED FIELDS	17%	14%	21%	29%
FIELD OF RESEARCH				
ENGINEERING	18%	17%	17%	30%
AGRICULTURAL SCIENCES	22%	20%	31%	41%
BIOLOGICAL SCIENCES	19%	15%	24%	37%
GRADUATE SCHOOLS	20%	16%	30%	26%
MEDICAL SCHOOLS	18%	14%	24%	42%
COMPUTER SCIENCE	17%	10%	25%	16%
ENVIRONMENTAL SCIENCES	19%	15%	22%	31%
MATERIALS SCIENCE	16%	6%	25%	31%
PHYSICAL SCIENCES	15%	12%	16%	24%
INTERDISCIPLINARY, N.E.C.	8%	7%	12%	6%

(1) ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 98 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. FOR PHASE II FIELDS (AGRICULTURAL, BIOLOGICAL AND ENVIRONMENTAL SCIENCES), ESTIMATES ARE AS OF DECEMBER 1983. FOR ALL OTHER FIELDS, ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 8704 INSTRUMENT SYSTEMS.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 17A. PERCENT OF ACADEMIC RESEARCH INSTRUMENT SYSTEMS THAT ARE CLASSIFIED AS STATE-OF-THE-ART, BY PURCHASE PRICE AND BY PHYSICAL SCIENCES AND ENGINEERING SUBFIELD [1]

	PERCENT OF SYSTEMS CLASSIFIED AS STATE-OF-THE-ART BY PURCHASE PRICE			
	TOTAL	$10,000-$24,999	$25,000-$74,999	$75,000-$1,000,000
PHYSICAL SCIENCES AND ENGINEERING				
PHYSICAL SCIENCES, TOTAL	20%	16%	21%	36%
CHEMISTRY	14%	14%	12%	21%
PHYSICS AND ASTRONOMY	16%	10%	21%	26%
ENGINEERING, TOTAL	18%	17%	17%	30%
CHEMICAL	16%	12%	13%	44%
CIVIL	13%	8%	22%	33%
ELECTRICAL	18%	15%	19%	29%
MECHANICAL	19%	19%	16%	22%
METALLURGICAL/ MATERIALS	15%	14%	16%	22%
OTHER, N.E.C.	21%	22%	18%	33%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES IN THE NATION. ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 3232 INSTRUMENT SYSTEMS.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 179. PERCENT OF ACADEMIC RESEARCH INSTRUMENT SYSTEMS THAT ARE CLASSIFIED AS STATE-OF-THE-ART, BY PURCHASE PRICE AND BY AGRICULTURAL AND BIOLOGICAL SCIENCES SUBFIELD [1]

	PERCENT OF SYSTEMS CLASSIFIED AS STATE-OF-THE-ART BY PURCHASE PRICE			
	TOTAL	$10,000-$24,999	$25,000-$74,999	$75,000-$1,000,000
AGRICULTURAL AND BIOLOGICAL SCIENCES				
AGRICULTURAL SCIENCES, TOTAL	22%	20%	31%	41%
AGRONOMIC SCIENCES	24%	19%	38%	42%
ANIMAL SCIENCES	23%	24%	19%	33%
NATURAL RESOURCE MGMT	13%	12%	13%	36%
BIOLOGICAL SCIENCES, TOTAL	19%	15%	26%	37%
ANATOMY	26%	28%	17%	49%
BIOCHEMISTRY	17%	14%	27%	34%
BOTANY	23%	18%	40%	45%
FOOD AND NUTRITION	16%	13%	24%	40%
MICROBIOLOGY/IMMUNOLOGY	15%	12%	24%	40%
MOLECULAR/CELLULAR BIOLOGY AND GENETICS	28%	22%	39%	49%
PATHOLOGY	16%	16%	13%	33%
PHARMACOLOGY/TOXICOLOGY	12%	9%	21%	34%
PHYSIOLOGY/BIOPHYSICS	18%	15%	22%	40%
ZOOLOGY/ENTOMOLOGY	25%	24%	27%	32%
BIOLOGY, GENERAL AND N.E.C.	13%	10%	23%	21%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES IN THE NATION. ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 4263 INSTRUMENT SYSTEMS.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 18. PERCENT OF ACADEMIC RESEARCH INSTRUMENT SYSTEMS IN NATIONAL STOCK CLASSIFIED AS STATE-OF-THE-ART, BY AGE AND BY FIELD [1]

	---PERCENT OF SYSTEMS CLASSIFIED AS STATE-OF-THE-ART---							
		AGE [2]						
	TOTAL	1	2	3	4	5	6-10	OVER 10
TOTAL, SELECTED FIELDS	18%	43%	36%	32%	22%	15%	10%	3%
FIELD OF RESEARCH								
ENGINEERING	19%	41%	36%	24%	18%	11%	9%	7%
AGRICULTURAL SCIENCES	22%	54%	51%	32%	30%	27%	7%	0%
BIOLOGICAL SCIENCES, TOTAL	19%	49%	41%	38%	25%	18%	9%	2%
GRADUATE SCHOOLS	20%	53%	45%	33%	26%	14%	13%	1%
MEDICAL SCHOOLS	18%	47%	37%	43%	24%	22%	7%	3%
COMPUTER SCIENCE	17%	38%	12%	4%	*	*	4%	0%
ENVIRONMENTAL SCIENCES	19%	43%	30%	36%	24%	9%	14%	6%
MATERIALS SCIENCE	16%	*	*	*	*	*	23%	0%
PHYSICAL SCIENCES	15%	35%	29%	34%	22%	14%	10%	2%
INTERDISCIPLINARY, N.E.C.	10%	*	*	*	*	*	19%	0%

* INSUFFICIENT SAMPLE: NUMBER OF SYSTEMS IS UNDER 20.

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 137 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. FOR PHASE II FIELDS (AGRICULTURAL, BIOLOGICAL AND ENVIRONMENTAL SCIENCES), ESTIMATES ARE AS OF DECEMBER 1983. FOR ALL OTHER FIELDS, ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 8704 INSTRUMENT SYSTEMS.

[2] AGE BASED ON YEAR OF PURCHASE. FOR PHASE II FIELDS, PURCHASED IN 1983 IS 1 YR OF AGE; 1982 (2 YRS); 1981 (3 YRS); 1980 (4 YRS); 1979 (5 YRS); 1974-78 (6-10 YRS); BEFORE 1974 (OVER 10 YRS OF AGE). FOR PHASE I FIELDS, PURCHASED IN 1982 IS 1 YR OF AGE; 1981 (2 YRS); 1980 (3 YRS); 1979 (4 YRS); 1978 (5 YRS); 1973-77 (6-10 YRS); BEFORE 1973 (OVER 10 YRS OF AGE).

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 18A. PERCENT OF ACADEMIC RESEARCH INSTRUMENT SYSTEMS IN NATIONAL STOCK CLASSIFIED AS STATE-OF-THE-ART, BY AGE AND BY PHYSICAL SCIENCES AND ENGINEERING SUBFIELD [1]

	---PERCENT OF SYSTEMS CLASSIFIED AS STATE-OF-THE-ART--- AGE [2]							
	TOTAL	1	2	3	4	5	6-10	OVER 10
PHYSICAL SCIENCES AND ENGINEERING								
PHYSICAL SCIENCES, TOTAL	15%	35%	29%	34%	22%	14%	10%	2%
CHEMISTRY	14%	33%	19%	38%	20%	12%	8%	0%
PHYSICS AND ASTRONOMY	16%	38%	40%	28%	25%	17%	12%	4%
ENGINEERING, TOTAL	19%	41%	36%	24%	18%	11%	9%	7%
CHEMICAL	16%	38%	38%	17%	*	*	3%	1%
CIVIL	15%	16%	36%	*	*	*	3%	3%
ELECTRICAL	18%	45%	39%	13%	7%	18%	2%	2%
MECHANICAL	19%	61%	51%	19%	20%	*	9%	0%
METALLURGICAL/MATERIALS	16%	23%	27%	31%	21%	*	6%	1%
OTHER, N.E.C.	22%	22%	32%	38%	26%	8%	17%	19%

* INSUFFICIENT SAMPLE: NUMBER OF SYSTEMS IS UNDER 20.

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES IN THE NATION. ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 3232 INSTRUMENT SYSTEMS.

[2] AGE BASED ON YEAR OF PURCHASE: PURCHASED IN 1982 (1 YR OF AGE); 1981 (2 YRS); 1980 (3 YRS); 1979 (4 YRS); 1978 (5 YRS;) 1973-77 (6-10 YRS); BEFORE 1973 (OVER 10 YRS).

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 18B. PERCENT OF ACADEMIC RESEARCH INSTRUMENT SYSTEMS IN NATIONAL STOCK CLASSIFIED AS STATE-OF-THE-ART, BY AGE AND BY AGRICULTURAL AND BIOLOGICAL SCIENCES SUBFIELD [1]

	---PERCENT OF SYSTEMS CLASSIFIED AS STATE-OF-THE-ART--- AGE [2]							
	TOTAL	1	2	3	4	5	6-10	OVER 10
AGRICULTURAL AND BIOLOGICAL SCIENCES								
AGRICULTURAL SCIENCES, TOTAL	22%	54%	51%	32%	30%	27%	7%	*
AGRONOMIC SCIENCES	24%	58%	54%	29%	52%	30%	7%	0%
ANIMAL SCIENCES	23%	*	45%	*	*	*	12%	2%
NATURAL RESOURCE MGMT	13%	*	*	*	*	*	*	0%
BIOLOGICAL SCIENCES, TOTAL	19%	49%	41%	38%	25%	18%	9%	2%
ANATOMY	26%	*	*	*	*	*	35%	4%
BIOCHEMISTRY	17%	55%	30%	36%	30%	12%	6%	2%
BOTANY	23%	*	58%	27%	*	*	9%	3%
FOOD AND NUTRITION	17%	*	*	*	*	*	7%	0%
MICROBIOLOGY/IMMUNOLOGY	15%	51%	23%	56%	35%	*	6%	0%
MOLECULAR/CELLULAR BIOLOGY AND GENETICS	28%	50%	68%	55%	19%	15%	17%	3%
PATHOLOGY	16%	*	*	*	*	*	8%	5%
PHARMACOLOGY/TOXICOLOGY	12%	37%	29%	35%	8%	12%	3%	2%
PHYSIOLOGY/BIOPHYSICS	18%	50%	39%	28%	32%	14%	7%	1%
ZOOLOGY/ENTOMOLOGY	25%	59%	*	*	34%	*	1%	5%
BIOLOGY, GENERAL AND N.E.C.	13%	38%	37%	28%	24%	5%	11%	2%

* INSUFFICIENT SAMPLE: NUMBER OF SYSTEMS IS UNDER 20.

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. ESTIMATES ARE AS OF DECEMBER 1983. SAMPLE IS 4263 INSTRUMENT SYSTEMS.

[2] AGE BASED ON YEAR OF PURCHASE: PURCHASED IN 1983 IS 1 YR OF AGE; 1982 (2 YRS); 1981 (3 YRS); 1980 (4 YRS); 1979 (5 YRS); 1974-78 (6-10 YRS OF AGE); BEFORE 1974 (OVER 10 YRS OF AGE).

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 19. AGE OF ACADEMIC INSTRUMENT SYSTEMS IN RESEARCH USE, BY FIELD [1]

	-----NUMBER AND PERCENT OF IN-USE SYSTEMS------ SYSTEM AGE (FROM YR OF PURCHASE)[2]			
	TOTAL	1-5 YEARS	6-10 YEARS	OVER 10 YEARS
TOTAL, SELECTED FIELDS	36350	19419	8757	8174
	100%	53%	24%	22%
FIELD OF RESEARCH				
ENGINEERING	6777	3969	1299	1509
	100%	59%	19%	22%
AGRICULTURAL SCIENCES	1653	952	447	253
	100%	58%	27%	15%
BIOLOGICAL SCIENCES, TOTAL	15055	7416	4242	3396
	100%	49%	28%	23%
GRADUATE SCHOOLS	6372	3323	1602	1447
	100%	52%	25%	23%
MEDICAL SCHOOLS	8683	4093	2641	1949
	100%	47%	30%	22%
COMPUTER SCIENCE	874	813	51	10
	100%	93%	6%	1%
ENVIRONMENTAL SCIENCES	2123	1217	546	361
	100%	57%	26%	17%
MATERIALS SCIENCE	650	235	103	312
	100%	36%	16%	48%
PHYSICAL SCIENCES	8763	4631	1872	2260
	100%	53%	21%	26%
INTERDISCIPLINARY, N.E.C.	454	185	196	73
	100%	41%	43%	16%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. FOR PHASE II FIELDS (AGRICULTURAL, BIOLOGICAL AND ENVIRONMENTAL SCIENCES), ESTIMATES ARE AS OF DECEMBER 1983. FOR ALL OTHER FIELDS, ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 7013 INSTRUMENT SYSTEMS.

[2] FOR PHASE II FIELDS, AGE INTERVALS ARE 1-5 YEARS (1979-83); 6-10 YEARS (1974-78); OVER 10 YEARS (1973 OR BEFORE). FOR PHASE I FIELDS, INTERVALS ARE 1-5 YEARS (1978-82); 6-10 YEARS (1973-77); OVER 10 YEARS (1972 OR BEFORE).

NOTE: SUBCATEGORY NUMBERS AND PERCENTAGES MAY NOT SUM EXACTLY TO TOTAL BECAUSE OF ROUNDING. ESTIMATED TOTALS MAY VARY SLIGHTLY FROM TABLE TO TABLE.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 19A. AGE OF ACADEMIC INSTRUMENT SYSTEMS IN RESEARCH USE, BY PHYSICAL SCIENCES AND ENGINEERING SUBFIELD [1]

	NUMBER AND PERCENT OF IN-USE SYSTEMS — SYSTEM AGE (FROM YR OF PURCHASE)[2]			
	TOTAL	1-5 YEARS	6-10 YEARS	OVER 10 YEARS
PHYSICAL SCIENCES AND ENGINEERING				
PHYSICAL SCIENCES, TOTAL	8763	4631	1872	2260
	100%	53%	21%	26%
CHEMISTRY	4830	2764	1144	921
	100%	57%	24%	19%
PHYSICS AND ASTRONOMY	3933	1866	728	1339
	100%	47%	19%	34%
ENGINEERING, TOTAL	6777	3969	1299	1509
	100%	59%	19%	22%
CHEMICAL	676	425	152	98
	100%	63%	23%	15%
CIVIL	395	208	60	127
	100%	53%	15%	32%
ELECTRICAL	1507	1113	229	165
	100%	74%	15%	11%
MECHANICAL	1322	771	159	392
	100%	58%	12%	30%
METALLURGICAL/MATERIALS	1095	686	188	220
	100%	63%	17%	20%
OTHER, N.E.C.	1783	765	511	507
	100%	43%	29%	28%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES IN THE NATION. ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 2446 INSTRUMENT SYSTEMS.

[2] AGE INTERVALS ARE 1-5 YEARS (1978-82); 6-10 YEARS (1973-77); OVER 10 YEARS (1972 OR BEFORE).

NOTE: SUBCATEGORY NUMBERS AND PERCENTAGES MAY NOT SUM EXACTLY TO TOTAL BECAUSE ROUNDING. ESTIMATED TOTALS MAY VARY SLIGHTLY FROM TABLE TO TABLE.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 19B. AGE OF ACADEMIC INSTRUMENT SYSTEMS IN RESEARCH USE, BY AGRICULTURAL AND BIOLOGICAL SCIENCES SUBFIELD [1]

	-----NUMBER AND PERCENT OF IN-USE SYSTEMS----- SYSTEM AGE (FROM YR OF PURCHASE)[2]		
	TOTAL	1-5 YEARS	6-10 YEARS	OVER 10 YEARS
AGRICULTURAL AND BIOLOGICAL SCIENCES				
AGRICULTURAL SCIENCES, TOTAL	1653	952	447	253
	100%	58%	27%	15%
AGRONOMIC SCIENCES	1042	584	298	160
	100%	56%	29%	15%
ANIMAL SCIENCES	429	245	117	68
	100%	57%	27%	16%
NATURAL RESOURCE MGMT	181	123	32	26
	100%	68%	18%	14%
BIOLOGICAL SCIENCES, TOTAL	13055	7416	4242	3396
	100%	49%	28%	23%
ANATOMY	461	206	98	157
	100%	45%	21%	34%
BIOCHEMISTRY	3695	1824	1008	863
	100%	49%	27%	23%
BOTANY	438	247	103	89
	100%	56%	23%	20%
FOOD AND NUTRITION	384	226	98	60
	100%	59%	25%	16%
MICROBIOLOGY/IMMUNOLOGY	1255	491	477	287
	100%	39%	38%	23%
MOLECULAR/CELLULAR BIOLOGY AND GENETICS	2735	1363	786	586
	100%	50%	29%	21%
PATHOLOGY	760	323	238	199
	100%	42%	31%	26%
PHARMACOLOGY/TOXICOLOGY	1644	793	485	366
	100%	48%	29%	22%
PHYSIOLOGY/BIOPHYSICS	1995	1093	458	445
	100%	55%	23%	22%
ZOOLOGY/ENTOMOLOGY	424	268	89	68
	100%	63%	21%	16%
BIOLOGY, GENERAL AND N.E.C.	1263	583	404	276
	100%	46%	32%	22%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. ESTIMATES ARE AS OF DECEMBER 1983. SAMPLE IS 2848 INSTRUMENT SYSTEMS.

[2] AGE INTERVALS ARE 1-5 YEARS (1979-83); 6-10 YEARS (1974-78); OVER 10 YEARS (1973 OR BEFORE).

NOTE: SUBCATEGORY NUMBERS AND PERCENTAGES MAY NOT SUM EXACTLY TO TOTAL BECAUSE OF ROUNDING. ESTIMATED TOTALS MAY VARY SLIGHTLY FROM TABLE TO TABLE.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 20. AGE OF STATE-OF-THE-ART ACADEMIC RESEARCH INSTRUMENT SYSTEMS, BY FIELD [1]

	NUMBER AND PERCENT OF STATE-OF-THE-ART SYSTEMS			
		SYSTEM AGE (FROM YR OF PURCHASE)[2]		
	TOTAL	1-5 YEARS	6-10 YEARS	OVER 10 YEARS
TOTAL, SELECTED FIELDS	8038	6575	1039	424
	100%	82%	13%	5%
FIELD OF RESEARCH				
ENGINEERING	1699	1360	156	183
	100%	80%	9%	11%
AGRICULTURAL SCIENCES	437	398	38	2
	100%	91%	9%	-
BIOLOGICAL SCIENCES, TOTAL	3251	2709	441	102
	100%	83%	14%	3%
GRADUATE SCHOOLS	1431	1172	233	25
	100%	82%	16%	2%
MEDICAL SCHOOLS	1821	1537	208	77
	100%	84%	11%	4%
COMPUTER SCIENCE	186	183	3	0
	100%	98%	2%	-
ENVIRONMENTAL SCIENCES	518	391	89	37
	100%	75%	17%	7%
MATERIALS SCIENCE	116	88	26	2
	100%	76%	22%	1%
PHYSICAL SCIENCES	1725	1392	237	96
	100%	81%	14%	6%
INTERDISCIPLINARY, N.E.C.	125	54	69	2
	100%	43%	55%	2%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. FOR PHASE II FIELDS (AGRICULTURAL, BIOLOGICAL AND ENVIRONMENTAL SCIENCES), ESTIMATES ARE AS OF DECEMBER 1983. FOR ALL OTHER FIELDS, ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 1603 INSTRUMENT SYSTEMS.

[2] FOR PHASE II FIELDS, AGE INTERVALS ARE 1-5 YEARS (1979-83); 6-10 YEARS (1974-78); OVER 10 YEARS (1973 OR BEFORE). FOR PHASE I FIELDS, INTERVALS ARE 1-5 YEARS (1978-82); 6-10 YEARS (1973-77); OVER 10 YEARS (1972 OR BEFORE).

NOTE: SUBCATEGORY NUMBERS AND PERCENTAGES MAY NOT SUM EXACTLY TO TOTAL BECAUSE OF ROUNDING. ESTIMATED TOTALS MAY VARY SLIGHTLY FROM TABLE TO TABLE.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 2DA. AGE OF STATE-OF-THE-ART ACADEMIC RESEARCH INSTRUMENT SYSTEMS, BY PHYSICAL SCIENCES AND ENGINEERING SUBFIELD [1]

	NUMBER AND PERCENT OF STATE-OF-THE-ART SYSTEMS			
		SYSTEM AGE (FROM YR OF PURCHASE)[2]		
	TOTAL	1-5 YEARS	6-10 YEARS	OVER 10 YEARS
PHYSICAL SCIENCES AND ENGINEERING				
PHYSICAL SCIENCES, TOTAL	1725	1392	237	96
	100%	81%	14%	6%
CHEMISTRY	893	771	115	7
	100%	86%	13%	1%
PHYSICS AND ASTRONOMY	833	621	122	89
	100%	75%	15%	11%
ENGINEERING, TOTAL	1699	1360	156	183
	100%	80%	9%	11%
CHEMICAL	134	125	6	2
	100%	94%	5%	2%
CIVIL	91	81	3	7
	100%	89%	3%	8%
ELECTRICAL	393	376	8	9
	100%	96%	2%	2%
MECHANICAL	346	323	21	2
	100%	93%	6%	1%
METALLURGICAL/MATERIALS	192	175	14	4
	100%	91%	7%	2%
OTHER, N.E.C.	543	280	104	159
	100%	52%	19%	29%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES IN THE NATION. ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 580 INSTRUMENT SYSTEMS.

[2] AGE INTERVALS ARE 1-5 YEARS (1978-82); 6-10 YEARS (1973-77); OVER 10 YEARS (1972 OR BEFORE).

NOTE: SUBCATEGORY NUMBERS AND PERCENTAGES MAY NOT SUM EXACTLY TO TOTAL BECAUSE OF ROUNDING. ESTIMATED TOTALS MAY VARY SLIGHTLY FROM TABLE TO TABLE.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 20B. AGE OF STATE-OF-THE-ART ACADEMIC RESEARCH INSTRUMENT SYSTEMS, BY AGRICULTURAL AND BIOLOGICAL SCIENCES SUBFIELD [1]

	NUMBER AND PERCENT OF STATE-OF-THE-ART SYSTEMS			
		SYSTEM AGE (FROM YR OF PURCHASE)[2]		
	TOTAL	1-5 YEARS	6-10 YEARS	OVER 10 YEARS
AGRICULTURAL AND BIOLOGICAL SCIENCES				
AGRICULTURAL SCIENCES, TOTAL	437	398	38	2
	100%	91%	9%	-
AGRONOMIC SCIENCES	294	270	23	0
	100%	92%	8%	-
ANIMAL SCIENCES	113	97	14	2
	100%	86%	13%	2%
NATURAL RESOURCE MGMT	30	30	0	0
	100%	100%	-	-
BIOLOGICAL SCIENCES, TOTAL	3251	2709	441	102
	100%	83%	14%	3%
ANATOMY	143	96	39	8
	100%	67%	27%	6%
BIOCHEMISTRY	691	604	67	20
	100%	87%	10%	3%
BOTANY	108	95	10	3
	100%	88%	9%	3%
FOOD AND NUTRITION	74	66	8	0
	100%	89%	11%	-
MICROBIOLOGY/IMMUNOLOGY	222	191	31	0
	100%	86%	14%	-
MOLECULAR/CELLULAR BIOLOGY AND GENETICS	807	655	135	17
	100%	81%	17%	2%
PATHOLOGY	163	122	24	17
	100%	75%	15%	11%
PHARMACOLOGY/TOXICOLOGY	231	199	19	13
	100%	86%	8%	5%
PHYSIOLOGY/BIOPHYSICS	433	387	40	6
	100%	89%	9%	1%
ZOOLOGY/ENTOMOLOGY	124	117	1	6
	100%	94%	1%	5%
BIOLOGY, GENERAL AND N.E.C.	255	177	66	11
	100%	70%	26%	4%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. ESTIMATES ARE AS OF DECEMBER 1983. SAMPLE IS 803 INSTRUMENT SYSTEMS.

[2] AGE INTERVALS ARE 1-5 YEARS (1979-83); 6-10 YEARS (1974-78); OVER 10 YEARS (1973 OR BEFORE).

NOTE: SUBCATEGORY NUMBERS AND PERCENTAGES MAY NOT SUM EXACTLY TO TOTAL BECAUSE OF ROUNDING. ESTIMATED TOTALS MAY VARY SLIGHTLY FROM TABLE TO TABLE.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 21. MEDIAN AGE OF ACADEMIC RESEARCH INSTRUMENT SYSTEMS, BY RESEARCH STATUS AND BY FIELD [1]

	MEDIAN AGE (IN YEARS) [2] BY RESEARCH STATUS				
		IN RESEARCH USE			
	TOTAL	STATE-OF-THE-ART	OTHER	NOT YET IN RESEARCH USE	NO LONGER IN RESEARCH USE
TOTAL, SELECTED FIELDS	6	3	6	1	12
FIELD OF RESEARCH					
ENGINEERING	5	2	5	1	11
AGRICULTURAL SCIENCES	5	3	6	2	12
BIOLOGICAL SCIENCES, TOTAL	6	3	6	1	12
GRADUATE SCHOOLS	6	3	6	1	12
MEDICAL SCHOOLS	6	3	7	1	12
COMPUTER SCIENCE	3	1	3	1	12
ENVIRONMENTAL SCIENCES	5	3	5	2	10
MATERIALS SCIENCE	11	2	12	1	15
PHYSICAL SCIENCES	6	3	6	3	12
INTERDISCIPLINARY, N.E.C.	9	7	7	1	14

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. FOR PHASE II FIELDS (AGRICULTURAL, BIOLOGICAL AND ENVIRONMENTAL SCIENCES), ESTIMATES ARE AS OF DECEMBER 1983. FOR ALL OTHER FIELDS, ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 8704 INSTRUMENT SYSTEMS.

[2] AGE BASED ON YEAR OF PURCHASE. FOR PHASE II FIELDS, PURCHASED IN 1983 IS 1 YR OF AGE; 1982 (2 YRS); 1981 (3 YRS); ETC. FOR PHASE I FIELDS, PURCHASED IN 1982 IS 1 YR OF AGE; 1981 (2 YRS); 1980 (3 YRS); ETC.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 21A. MEDIAN AGE OF ACADEMIC RESEARCH INSTRUMENT SYSTEMS, BY RESEARCH STATUS AND BY PHYSICAL SCIENCES AND ENGINEERING SUBFIELD [1]

	MEDIAN AGE (IN YEARS) [2] BY RESEARCH STATUS				
		----IN RESEARCH USE-----			
	TOTAL	STATE-OF-THE-ART	OTHER	NOT YET IN RESEARCH USE	NO LONGER IN RESEARCH USE
PHYSICAL SCIENCES AND ENGINEERING					
PHYSICAL SCIENCES, TOTAL	6	3	6	3	12
CHEMISTRY	6	3	5	3	12
PHYSICS AND ASTRONOMY	7	3	7	2	14
ENGINEERING, TOTAL	5	2	5	1	11
CHEMICAL	4	2	5	1	10
CIVIL	6	3	7	1	12
ELECTRICAL	4	2	4	2	8
MECHANICAL	6	1	6	1	12
METALLURGICAL/MATERIALS	4	3	5	3	11
OTHER, N.E.C	8	6	8	1	11

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES IN THE NATION. ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 3232 INSTRUMENT SYSTEMS.

[2] AGE BASED ON YEAR OF PURCHASE: PURCHASED IN 1982 IS 1 YR OF AGE; 1981 (2 YRS); 1980 (3 YRS); ETC.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 218. MEDIAN AGE OF ACADEMIC RESEARCH INSTRUMENT SYSTEMS, BY RESEARCH STATUS AND BY AGRICULTURAL AND BIOLOGICAL SCIENCES SUBFIELD (1)

	MEDIAN AGE (IN YEARS) (2) BY RESEARCH STATUS				
		IN RESEARCH USE			
	TOTAL	STATE-OF-THE-ART	OTHER	NOT YET IN RESEARCH USE	NO LONGER IN RESEARCH USE
AGRICULTURAL AND BIOLOGICAL SCIENCES					
AGRICULTURAL SCIENCES, TOTAL	5	3	6	2	12
AGRONOMIC SCIENCES	5	3	6	1	11
ANIMAL SCIENCES	5	2	6	2	12
NATURAL RESOURCE MGMT	5	2	4	1	14
BIOLOGICAL SCIENCES, TOTAL	6	3	6	1	12
ANATOMY	6	5	10	-	11
BIOCHEMISTRY	6	3	6	1	10
BOTANY	5	2	6	-	14
FOOD AND NUTRITION	5	3	5	1	12
MICROBIOLOGY/IMMUNOLOGY	7	3	8	4	12
MOLECULAR/CELLULAR BIOLOGY AND GENETICS	6	2	7	-	12
PATHOLOGY	8	5	8	1	12
PHARMACOLOGY/TOXICOLOGY	6	3	6	1	13
PHYSIOLOGY/BIOPHYSICS	6	3	6	1	11
ZOOLOGY/ENTOMOLOGY	5	2	5	1	14
BIOLOGY, GENERAL AND N.E.C.	8	3	7	1	14

(1) ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 4263 INSTRUMENT SYSTEMS.

(2) AGE BASED ON YEAR OF PURCHASE: PURCHASED IN 1982 IS 1 YR OF AGE; 1981 (2 YRS); 1980 (3 YRS); ETC.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 22. CONDITION OF ACADEMIC RESEARCH INSTRUMENT SYSTEMS IN USE, BY SYSTEM AGE [1]

	NUMBER AND PERCENT OF SYSTEMS, BY GENERAL WORKING CONDITION			
	TOTAL	EXCELLENT	AVERAGE	POOR
TOTAL, SELECTED FIELDS	36250	18849	13774	3627
	100%	52%	38%	10%
AGE (FROM YR OF PURCHASE) [2]				
1-5 YEARS	19351	13227	5396	728
	100%	68%	28%	4%
6-10 YEARS	8747	3449	4226	1072
	100%	39%	48%	12%
OVER 10 YEARS	8152	2172	4153	1827
	100%	27%	51%	22%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. FOR PHASE II FIELDS (AGRICULTURAL, BIOLOGICAL AND ENVIRONMENTAL SCIENCES), ESTIMATES ARE AS OF DECEMBER 1983. FOR ALL OTHER FIELDS, ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 7013 INSTRUMENT SYSTEMS.

[2] FOR PHASE II FIELDS, AGE INTERVALS ARE 1-5 (1979-83); 6-10 YEARS (1974-78); OVER 10 YEARS (1973 OR BEFORE). FOR PHASE I FIELDS, INTERVALS ARE 1-5 YEARS (1978-82; 6-10 YEARS (1973-77); OVER 10 YEARS (1972 OR BEFORE).

NOTE: SUBCATEGORY NUMBERS AND PERCENTAGES MAY NOT SUM EXACTLY TO TOTAL BECAUSE OF ROUNDING. ESTIMATED TOTALS MAY VARY FROM TABLE TO TABLE.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 23. PERCENT OF IN-USE RESEARCH INSTRUMENT SYSTEMS IN EXCELLENT WORKING CONDITION, BY SYSTEM RESEARCH STATUS AND BY FIELD [1]

	PERCENT OF SYSTEMS IN EXCELLENT WORKING CONDITION		
		RESEARCH STATUS	
	TOTAL	STATE-OF-THE-ART SYSTEMS	OTHER IN-USE SYSTEMS
TOTAL, SELECTED FIELDS	52%	84%	43%
FIELD OF RESEARCH			
ENGINEERING	51%	85%	40%
AGRICULTURAL SCIENCES	56%	81%	47%
BIOLOGICAL SCIENCES, TOTAL	53%	86%	44%
GRADUATE SCHOOLS	55%	90%	44%
MEDICAL SCHOOLS	52%	82%	44%
COMPUTER SCIENCE	56%	89%	47%
ENVIRONMENTAL SCIENCES	50%	82%	40%
MATERIALS SCIENCE	32%	74%	23%
PHYSICAL SCIENCES	52%	84%	44%
INTERDISCIPLINARY, N.E.C.	44%	58%	39%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. FOR PHASE II FIELDS (AGRICULTURAL, BIOLOGICAL AND ENVIRONMENTAL SCIENCES), ESTIMATES ARE AS OF DECEMBER 1983. FOR ALL OTHER FIELDS, ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 7013 INSTRUMENT SYSTEMS.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 23A. PERCENT OF IN-USE RESEARCH INSTRUMENT SYSTEMS IN EXCELLENT WORKING CONDITION, BY SYSTEM RESEARCH STATUS AND BY PHYSICAL SCIENCES AND ENGINEERING SUBFIELD [1]

	PERCENT OF SYSTEMS IN EXCELLENT WORKING CONDITION		
		RESEARCH STATUS	
	TOTAL	STATE-OF-THE-ART SYSTEMS	OTHER IN-USE SYSTEMS
PHYSICAL SCIENCES AND ENGINEERING			
PHYSICAL SCIENCES, TOTAL	52%	84%	44%
CHEMISTRY	51%	87%	43%
PHYSICS AND ASTRONOMY	53%	81%	45%
ENGINEERING, TOTAL	51%	83%	40%
CHEMICAL	39%	77%	29%
CIVIL	37%	76%	26%
ELECTRICAL	54%	92%	41%
MECHANICAL	53%	83%	43%
METALLURGICAL/MATERIALS	55%	87%	48%
OTHER, N.E.C.	52%	83%	38%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES IN THE NATION. ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 2446 INSTRUMENT SYSTEMS.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 23B. PERCENT OF IN-USE RESEARCH INSTRUMENT SYSTEMS IN EXCELLENT WORKING CONDITION, BY SYSTEM RESEARCH STATUS AND BY AGRICULTURAL AND BIOLOGICAL SCIENCES SUBFIELD [1]

	PERCENT OF SYSTEMS IN EXCELLENT WORKING CONDITION		
		RESEARCH STATUS	
	TOTAL	STATE-OF-THE-ART SYSTEMS	OTHER IN-USE SYSTEMS
AGRICULTURAL AND BIOLOGICAL SCIENCES			
AGRICULTURAL SCIENCES, TOTAL	56%	81%	47%
AGRONOMIC SCIENCES	59%	82%	50%
ANIMAL SCIENCES	55%	78%	47%
NATURAL RESOURCE MGMT	42%	82%	35%
BIOLOGICAL SCIENCES, TOTAL	53%	86%	44%
ANATOMY	59%	82%	48%
BIOCHEMISTRY	46%	78%	39%
BOTANY	55%	71%	50%
FOOD AND NUTRITION	54%	81%	48%
MICROBIOLOGY/IMMUNOLOGY	49%	82%	42%
MOLECULAR/CELLULAR BIOLOGY AND GENETICS	59%	90%	46%
PATHOLOGY	49%	88%	39%
PHARMACOLOGY/TOXICOLOGY	46%	81%	40%
PHYSIOLOGY/BIOPHYSICS	58%	92%	48%
ZOOLOGY/ENTOMOLOGY	64%	94%	51%
BIOLOGY, GENERAL AND N.E.C.	61%	92%	53%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. ESTIMATES ARE AS OF DECEMBER 1983. SAMPLE IS 2848 INSTRUMENT SYSTEMS.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 24. PERCENT OF IN-USE ACADEMIC RESEARCH INSTRUMENT SYSTEMS THAT ARE THE "MOST ADVANCED INSTRUMENT OF ITS KIND ACCESSIBLE TO ITS RESEARCH USERS," [1] BY RESEARCH STATUS AND BY FIELD [2]

	RESEARCH STATUS		
	TOTAL	STATE-OF-THE-ART	OTHER
TOTAL, SELECTED FIELDS	58%	97%	46%
FIELD OF RESEARCH			
ENGINEERING	61%	96%	50%
AGRICULTURAL SCIENCES	66%	94%	56%
BIOLOGICAL SCIENCES	55%	97%	43%
GRADUATE SCHOOLS	56%	97%	44%
MEDICAL SCHOOLS	54%	97%	43%
COMPUTER SCIENCE	61%	99%	51%
ENVIRONMENTAL SCIENCES	60%	98%	47%
MATERIALS SCIENCE	46%	100%	35%
PHYSICAL SCIENCES	59%	97%	49%
INTERDISCIPLINARY, N.E.C.	52%	96%	36%

[1] ALTERNATIVE TO THIS CLASSIFICATION IS "SYSTEM USED FOR RESEARCH, BUT MORE ADVANCED INSTRUMENTS ARE AVAILABLE TO USERS WHEN NEEDED".

[2] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. FOR PHASE II FIELDS (AGRICULTURAL, BIOLOGICAL AND ENVIRONMENTAL SCIENCES), ESTIMATES ARE AS OF DECEMBER 1983. FOR ALL OTHER FIELDS, ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 7013 INSTRUMENT SYSTEMS.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 24A. PERCENT OF IN-USE ACADEMIC RESEARCH INSTRUMENT SYSTEMS THAT ARE THE "MOST ADVANCED INSTRUMENT OF ITS KIND ACCESSIBLE TO ITS RESEARCH USERS," [1] BY RESEARCH STATUS AND BY PHYSICAL SCIENCES AND ENGINEERING SUBFIELD [2]

	RESEARCH STATUS		
	TOTAL	STATE-OF-THE-ART	OTHER
PHYSICAL SCIENCES AND ENGINEERING			
PHYSICAL SCIENCES, TOTAL	59%	97%	49%
CHEMISTRY	53%	48%	36%
PHYSICS AND ASTRONOMY	56%	96%	45%
ENGINEERING, TOTAL	61%	96%	50%
CHEMICAL	58%	96%	48%
CIVIL	52%	94%	40%
ELECTRICAL	54%	93%	41%
MECHANICAL	62%	95%	50%
METALLURGICAL/MATERIALS	64%	98%	56%
OTHER, N.E.C.	69%	98%	56%

[1] ALTERNATIVE TO THIS CLASSIFICATION IS "SYSTEM USED FOR RESEARCH, BUT MORE ADVANCED INSTRUMENTS ARE AVAILABLE TO USERS WHEN NEEDED".

[2] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES IN THE NATION. ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 2446 INSTRUMENT SYSTEMS.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 24B. PERCENT OF IN-USE ACADEMIC RESEARCH INSTRUMENT SYSTEMS THAT ARE THE "MOST ADVANCED INSTRUMENT OF ITS KIND ACCESSIBLE TO ITS RESEARCH USERS," [1] BY RESEARCH STATUS AND BY AGRICULTURAL AND BIOLOGICAL SCIENCES SUBFIELD [2]

	RESEARCH STATUS		
	TOTAL	STATE-OF-THE-ART	OTHER
AGRICULTURAL AND BIOLOGICAL SCIENCES			
AGRICULTURAL SCIENCES, TOTAL	66%	94%	56%
AGRONOMIC SCIENCES	67%	97%	56%
ANIMAL SCIENCES	69%	87%	62%
NATURAL RESOURCE MGMT	53%	93%	45%
BIOLOGICAL SCIENCES, TOTAL	55%	97%	43%
ANATOMY	70%	100%	57%
BIOCHEMISTRY	49%	96%	38%
BOTANY	56%	94%	43%
FOOD AND NUTRITION	69%	88%	65%
MICROBIOLOGY/IMMUNOLOGY	50%	98%	40%
MOLECULAR/CELLULAR BIOLOGY AND GENETICS	56%	98%	38%
PATHOLOGY	59%	99%	48%
PHARMACOLOGY/TOXICOLOGY	52%	97%	45%
PHYSIOLOGY/BIOPHYSICS	53%	97%	41%
ZOOLOGY/ENTOMOLOGY	72%	99%	60%
BIOLOGY, GENERAL AND N.E.C.	62%	99%	53%

[1] ALTERNATIVE TO THIS CLASSIFICATION IS "SYSTEM USED FOR RESEARCH, BUT MORE ADVANCED INSTRUMENTS ARE AVAILABLE TO USERS WHEN NEEDED".

[2] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. ESTIMATES ARE AS OF DECEMBER 1983. SAMPLE IS 2848 INSTRUMENT SYSTEMS.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 23. MEANS OF ACQUISITION OF IN-USE ACADEMIC RESEARCH INSTRUMENT SYSTEMS, BY FIELD [1]

	NUMBER AND PERCENT OF IN-USE SYSTEMS							
		MEANS OF ACQUISITION						
	TOTAL	PURCHASED NEW	LOCALLY BUILT	PURCHASED USED	DONATED NEW	DONATED USED	GOV'T SURPLUS	OTHER
TOTAL, SELECTED FIELDS	36351	32409	942	1342	410	317	409	522
	100%	89%	3%	4%	1%	1%	1%	1%
FIELD OF RESEARCH								
ENGINEERING	6786	5613	379	209	309	126	78	72
	100%	83%	6%	3%	5%	2%	1%	1%
AGRICULTURAL SCIENCES	1650	1575	17	39	4	2	5	9
	100%	95%	1%	2%	-	-	-	1%
BIOLOGICAL SCIENCES, TOTAL	15043	14138	71	475	22	36	43	259
	100%	94%	-	3%	-	-	-	2%
GRADUATE SCHOOLS	6358	5959	40	234	4	13	10	98
	100%	94%	1%	4%	-	-	-	2%
MEDICAL SCHOOLS	8685	8179	31	241	17	24	32	162
	100%	94%	-	3%	-	-	-	2%
COMPUTER SCIENCE	876	766	0	56	30	23	0	0
	100%	87%	-	6%	3%	3%	-	-
ENVIRONMENTAL SCIENCES	2122	1756	98	103	26	31	88	19
	100%	83%	5%	5%	1%	1%	4%	1%
MATERIALS SCIENCE	650	619	7	22	0	0	0	2
	100%	95%	1%	3%	-	-	-	-
PHYSICAL SCIENCES	8770	7502	366	428	20	98	196	161
	100%	86%	4%	5%	-	1%	2%	2%
INTERDISCIPLINARY, N.E.C.	454	440	4	10	0	0	0	0
	100%	97%	1%	2%	-	-	-	-

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. FOR PHASE II FIELDS (AGRICULTURAL, BIOLOGICAL AND ENVIRONMENTAL SCIENCES), ESTIMATES ARE AS OF DECEMBER 1983. FOR ALL OTHER FIELDS, ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 7013 INSTRUMENT SYSTEMS.

NOTE: SUBCATEGORY NUMBERS AND PERCENTAGES MAY NOT SUM EXACTLY TO TOTAL BECAUSE OF ROUNDING. ESTIMATED TOTALS MAY VARY SLIGHTLY FROM TABLE TO TABLE.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 23A. MEANS OF ACQUISITION OF IN-USE ACADEMIC RESEARCH INSTRUMENT SYSTEMS, BY PHYSICAL SCIENCES AND ENGINEERING SUBFIELD [1]

	NUMBER AND PERCENT OF IN-USE SYSTEMS							
		MEANS OF ACQUISITION						
		PURCHASED NEW	LOCALLY BUILT	PURCHASED USED	DONATED NEW	DONATED USED	GOV'T SURPLUS	OTHER
PHYSICAL SCIENCES AND ENGINEERING	TOTAL							
PHYSICAL SCIENCES, TOTAL	8770	7502	366	428	20	98	196	161
	100%	86%	4%	5%	-	1%	2%	2%
CHEMISTRY	4849	4174	56	326	12	86	108	86
	100%	86%	1%	7%	-	2%	2%	2%
PHYSICS AND ASTRONOMY	3921	3328	310	102	7	12	87	75
	100%	85%	8%	3%	-	-	2%	2%
ENGINEERING, TOTAL	6786	5613	379	209	309	126	78	72
	100%	83%	6%	3%	5%	2%	1%	1%
CHEMICAL	673	644	0	18	0	3	0	7
	100%	96%	-	3%	-	-	-	1%
CIVIL	390	359	4	18	2	0	3	5
	100%	92%	1%	5%	-	-	1%	1%
ELECTRICAL	1511	1195	73	49	97	36	56	5
	100%	79%	5%	3%	6%	2%	4%	-
MECHANICAL	1339	1136	141	12	18	20	0	12
	100%	85%	11%	1%	1%	2%	-	1%
METALLURGICAL/MATERIALS	1092	968	37	25	2	48	0	13
	100%	89%	3%	2%	-	4%	-	1%
OTHER, N.E.C.	1781	1311	125	88	190	19	19	29
	100%	74%	7%	5%	11%	1%	1%	2%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES IN THE NATION. ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 2446 INSTRUMENT SYSTEMS.

NOTE: SUBCATEGORY NUMBERS AND PERCENTAGES MAY NOT SUM EXACTLY TO TOTAL BECAUSE OF ROUNDING. ESTIMATED TOTALS MAY VARY SLIGHTLY FROM TABLE TO TABLE.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 25B. MEANS OF ACQUISITION OF IN-USE ACADEMIC RESEARCH INSTRUMENT SYSTEMS, BY AGRICULTURAL AND BIOLOGICAL SCIENCES SUBFIELD [1]

	NUMBER AND PERCENT OF IN-USE SYSTEMS							
	MEANS OF ACQUISITION							
	TOTAL	PURCHASED NEW	LOCALLY BUILT	PURCHASED USED	DONATED NEW	DONATED USED	GOV'T SURPLUS	OTHER
AGRICULTURAL AND BIOLOGICAL SCIENCES								
AGRICULTURAL SCIENCES, TOTAL	1650	1575	17	39	4	2	5	9
	100%	95%	1%	2%	-	-	-	1%
AGRONOMIC SCIENCES	1039	1006	11	19	2	2	0	0
	100%	97%	1%	2%	-	-	-	-
ANIMAL SCIENCES	429	412	0	8	0	0	0	9
	100%	96%	-	2%	-	-	-	2%
NATURAL RESOURCE MGMT	181	157	6	12	2	0	5	0
	100%	87%	3%	7%	1%	-	2%	-
BIOLOGICAL SCIENCES, TOTAL	15043	14138	71	475	22	36	43	259
	100%	94%	-	3%	-	-	-	2%
ANATOMY	461	417	0	35	0	0	0	10
	100%	90%	-	7%	-	-	-	2%
BIOCHEMISTRY	3693	3502	4	110	2	17	0	59
	100%	95%	-	3%	-	-	-	2%
BOTANY	438	424	0	8	0	0	4	2
	100%	97%	-	2%	-	-	1%	-
FOOD AND NUTRITION	389	367	2	17	0	3	0	0
	100%	94%	-	4%	-	1%	-	-
MICROBIOLOGY/IMMUNOLOGY	1246	1194	2	18	0	12	9	11
	100%	96%	-	1%	-	1%	1%	1%
MOLECULAR/CELLULAR BIOLOGY AND GENETICS	2720	2583	2	79	0	0	0	56
	100%	95%	-	3%	-	-	-	2%
PATHOLOGY	760	713	0	22	9	0	0	15
	100%	94%	-	3%	1%	-	-	2%
PHARMACOLOGY/TOXICOLOGY	1648	1564	15	52	0	0	9	9
	100%	95%	1%	3%	-	-	1%	1%
PHYSIOLOGY/BIOPHYSICS	1993	1807	22	63	6	4	21	70
	100%	91%	1%	3%	-	-	1%	4%
ZOOLOGY/ENTOMOLOGY	424	389	6	23	2	0	0	5
	100%	92%	1%	5%	-	-	-	1%
BIOLOGY, GENERAL AND N.E.C.	1270	1178	18	47	3	0	0	24
	100%	93%	1%	4%	-	-	-	2%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. ESTIMATES ARE AS OF DECEMBER 1983. SAMPLE IS 2848 INSTRUMENT SYSTEMS.

NOTE: SUBCATEGORY NUMBERS AND PERCENTAGES MAY NOT SUM EXACTLY TO TOTAL BECAUSE OF ROUNDING. ESTIMATED TOTALS MAY VARY SLIGHTLY FROM TABLE TO TABLE.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 26. SOURCES OF FUNDS FOR ACQUISITION OF IN-USE ACADEMIC RESEARCH EQUIPMENT, BY FIELD [1]

[DOLLARS IN MILLIONS]

	ACQUISITION COST AND PERCENT OF COST												
		SOURCE OF FUNDS											
		FEDERAL								UNIV.	STATE	BUSI-	
	TOTAL	TOTAL	NSF	NIH	DOD	DOE	NASA	USDA	OTHER	FUNDS	GOVT.	NESS	OTHER
TOTAL, SELECTED FIELDS	$1178.0	$640.3	$230.8	$176.5	$103.9	$63.1	$30.8	$5.0	$30.2	$371.5	$61.5	$43.2	$61.5
	100%	54%	20%	15%	9%	5%	3%	-	3%	32%	5%	4%	5%
FIELD OF RESEARCH													
ENGINEERING	218.9	106.4	35.1	2.7	45.8	14.4	2.2	.3	5.8	78.5	13.5	13.1	7.4
	100%	49%	16%	1%	21%	7%	1%	-	3%	36%	6%	6%	3%
AGRICULTURAL SCIENCES	36.1	7.8	1.7	1.3	0	.3	.3	2.7	1.5	17.8	6.7	1.8	2.1
	100%	21%	5%	4%	-	1%	1%	7%	4%	49%	18%	5%	6%
BIOLOGICAL SCIENCES, TOTAL	381.3	198.5	35.3	149.7	2.1	3.5	.4	1.9	5.5	131.2	18.6	6.5	26.5
	100%	52%	9%	39%	1%	1%	-	-	1%	34%	5%	2%	7%
GRADUATE SCHOOLS	156.1	80.6	24.5	48.9	1.0	.7	.4	1.7	3.5	48.2	13.0	4.3	10.0
	100%	52%	16%	31%	1%	-	-	1%	2%	31%	8%	3%	6%
MEDICAL SCHOOLS	225.2	117.9	10.8	100.8	1.2	2.9	0	.2	2.1	83.0	5.5	2.3	16.4
	100%	52%	5%	45%	-	1%	-	-	1%	37%	2%	1%	7%
COMPUTER SCIENCE	46.9	21.5	10.8	.3	9.1	.3	0	0	1.0	11.5	4.9	7.7	1.2
	100%	46%	23%	1%	19%	1%	-	-	2%	25%	10%	16%	3%
ENVIRONMENTAL SCIENCES	92.3	45.7	16.5	.5	6.6	8.2	5.4	0	8.5	27.5	7.2	8.4	3.5
	100%	50%	18%	-	7%	9%	6%	-	9%	30%	8%	9%	4%
MATERIALS SCIENCE	34.1	24.3	13.5	.7	5.4	3.4	0	0	1.3	6.0	2.6	.6	.6
	100%	71%	40%	2%	16%	10%	-	-	4%	18%	8%	2%	2%
PHYSICAL SCIENCES	351.9	229.1	116.1	19.5	32.3	33.0	22.3	.1	5.7	92.2	6.6	4.1	20.0
	100%	65%	33%	6%	9%	9%	6%	-	2%	26%	2%	1%	6%
INTERDISCIPLINARY, N.E.C.	16.6	7.0	1.8	1.9	2.4	0	0	0	.9	6.8	1.5	.9	.4
	100%	42%	11%	11%	15%	-	-	-	5%	41%	9%	6%	2%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. FOR PHASE II FIELDS (AGRICULTURAL, BIOLOGICAL AND ENVIRONMENTAL SCIENCES), ESTIMATES ARE AS OF DECEMBER 1983. FOR ALL OTHER FIELDS, ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 7013 INSTRUMENT SYSTEMS.

NOTE: SUBCATEGORY NUMBERS AND PERCENTAGES MAY NOT SUM EXACTLY TO TOTAL BECAUSE OF ROUNDING. ESTIMATED TOTALS MAY VARY SLIGHTLY FROM TABLE TO TABLE.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 26A. SOURCES OF FUNDS FOR ACQUISITION OF IN-USE ACADEMIC RESEARCH EQUIPMENT, BY PHYSICAL SCIENCES AND ENGINEERING SUBFIELD [1]

[DOLLARS IN MILLIONS]

	ACQUISITION COST AND PERCENT OF COST												
	SOURCE OF FUNDS												
		FEDERAL								UNIV.	STATE	BUSI-	
	TOTAL	TOTAL	NSF	NIH	DOD	DOE	NASA	USDA	OTHER	FUNDS	GOVT.	NESS	OTHER
PHYSICAL SCIENCES AND ENGINEERING													
PHYSICAL SCIENCES, TOTAL	$351.9	$229.1	$116.1	$19.5	$32.3	$33.0	$22.3	$.1	$5.7	$92.2	$6.6	$4.1	$20.0
	100%	65%	33%	6%	9%	9%	6%	-	2%	26%	2%	1%	6%
CHEMISTRY	139.9	103.0	66.3	18.1	8.9	5.5	1.1	.1	3.1	68.4	5.7	3.5	9.3
	100%	54%	35%	10%	5%	3%	1%	-	2%	36%	3%	2%	5%
PHYSICS AND ASTRONOMY	162.0	126.1	49.9	1.5	23.4	27.8	21.3	0	2.4	23.8	.8	.6	10.6
	100%	78%	31%	1%	14%	17%	13%	-	2%	15%	-	-	7%
ENGINEERING, TOTAL	218.9	106.4	35.1	2.7	45.8	14.4	2.2	.3	5.8	78.5	13.5	13.1	7.4
	100%	49%	16%	1%	21%	7%	1%	-	3%	36%	6%	6%	3%
CHEMICAL	21.7	13.4	5.7	.2	5.4	1.2	.2	0	.7	5.4	1.0	1.7	.3
	100%	62%	26%	1%	25%	6%	1%	-	3%	25%	5%	8%	1%
CIVIL	12.6	8.4	1.6	0	.1	.4	0	0	.2	7.8	1.3	.6	.5
	100%	80%	13%	-	1%	3%	-	-	2%	62%	10%	5%	4%
ELECTRICAL	47.1	32.9	10.0	1.2	17.8	2.8	.2	0	.8	10.1	.8	2.3	1.0
	100%	70%	21%	3%	38%	6%	-	-	2%	21%	2%	5%	2%
MECHANICAL	45.9	23.6	7.1	0	12.3	2.8	.9	0	.5	13.3	1.8	4.9	2.3
	100%	51%	15%	-	27%	6%	2%	-	1%	29%	4%	11%	5%
METALLURGICAL/MATERIALS	37.4	17.4	7.2	0	2.3	4.7	.3	0	2.8	10.0	5.8	2.3	1.9
	100%	47%	19%	-	6%	13%	1%	-	7%	27%	16%	6%	5%
OTHER, N.E.C.	54.2	16.9	3.4	1.3	7.9	2.3	.4	.3	.7	31.8	2.8	1.2	1.5
	100%	31%	7%	2%	15%	5%	1%	1%	1%	59%	5%	2%	3%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES IN THE NATION. ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 2446 INSTRUMENT SYSTEMS.

NOTE: SUBCATEGORY NUMBERS AND PERCENTAGES MAY NOT SUM EXACTLY TO TOTAL BECAUSE OF ROUNDING. ESTIMATED TOTALS MAY VARY SLIGHTLY FROM TABLE TO TABLE.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 2b9. SOURCES OF FUNDS FOR ACQUISITION OF IN-USE ACADEMIC RESEARCH EQUIPMENT, BY AGRICULTURAL AND BIOLOGICAL SCIENCES SUBFIELD [1]

[DOLLARS IN MILLIONS]

	ACQUISITION COST AND PERCENT OF COST												
	SOURCE OF FUNDS												
		FEDERAL								UNIV.	STATE	BUSI-	
	TOTAL	TOTAL	NSF	NIH	DOD	DOE	NASA	USDA	OTHER	FUNDS	GOVT.	NESS	OTHER
AGRICULTURAL AND BIOLOGICAL SCIENCES													
AGRICULTURAL SCIENCES, TOTAL	936.1	67.8	91.7	61.3	90	9.3	9.3	62.7	91.5	917.8	96.7	91.8	62.1
	100%	21%	2%	4%	-	1%	1%	7%	4%	49%	10%	5%	6%
AGRONOMIC SCIENCES	23.7	4.7	.9	.6	0	.2	.1	1.6	1.2	11.8	5.0	1.1	1.1
	100%	20%	4%	2%	-	1%	-	7%	5%	50%	21%	5%	5%
ANIMAL SCIENCES	8.7	2.0	.2	.8	0	0	0	.9	.1	4.6	1.1	.5	.6
	100%	23%	3%	9%	-	-	-	11%	1%	51%	13%	6%	7%
NATURAL RESOURCE MGMT	3.8	1.1	.6	0	0	0	.2	.1	.2	1.6	.6	.2	.3
	100%	30%	15%	-	-	1%	5%	4%	4%	42%	15%	5%	9%
BIOLOGICAL SCIENCES, TOTAL	381.3	198.5	35.3	149.7	3.1	3.5	.4	1.9	5.5	131.2	18.6	6.5	26.5
	100%	52%	9%	39%	1%	1%	-	-	1%	34%	5%	2%	7%
ANATOMY	12.7	6.9	1.3	5.2	0	0	0	0	.4	3.6	.4	.2	1.6
	100%	54%	10%	41%	-	-	-	-	3%	29%	3%	2%	12%
BIOCHEMISTRY	82.9	51.7	8.2	42.3	.4	.3	.1	.1	.3	25.4	.8	.8	4.2
	100%	62%	10%	51%	1%	-	-	-	-	31%	1%	1%	5%
BOTANY	11.2	6.0	4.7	.8	0	.1	.1	.2	.2	3.1	1.1	.7	.3
	100%	54%	42%	7%	-	1%	1%	1%	2%	28%	10%	6%	3%
FOOD AND NUTRITION	7.9	1.7	.9	.2	0	0	0	.1	.2	3.3	2.3	.2	.1
	100%	21%	11%	6%	-	-	-	1%	2%	42%	29%	6%	1%
MICROBIOLOGY/IMMUNOLOGY	30.2	13.0	2.7	8.8	.1	.1	.1	.1	1.2	14.1	1.0	.3	1.9
	100%	43%	9%	29%	-	-	-	-	4%	47%	3%	1%	6%
MOLECULAR/CELLULAR BIOLOGY AND GENETICS	74.6	36.2	5.9	27.0	.1	.1	.1	.4	.6	33.6	2.2	2.0	2.6
	100%	46%	8%	36%	-	-	-	-	1%	45%	3%	3%	3%
PATHOLOGY	22.4	8.0	.3	7.1	0	0	0	.3	.2	12.2	.8	0	1.4
	100%	36%	2%	32%	-	-	-	1%	1%	54%	3%	-	6%
PHARMACOLOGY/TOXICOLOGY	33.6	18.8	1.0	14.6	.7	.7	0	.2	1.5	10.5	1.1	.4	2.9
	100%	56%	3%	44%	2%	2%	-	1%	5%	31%	3%	1%	9%
PHYSIOLOGY/BIOPHYSICS	56.8	33.4	5.5	27.1	.2	0	0	.1	.6	12.6	2.5	.8	7.4
	100%	59%	10%	48%	-	-	-	-	1%	22%	4%	1%	13%
ZOOLOGY/ENTOMOLOGY	9.2	5.2	1.3	3.6	.2	0	0	0	0	3.2	.3	.3	.7
	100%	56%	14%	37%	6%	-	-	-	-	33%	3%	3%	8%
BIOLOGY, GENERAL AND N.E.C.	39.4	19.7	4.0	12.7	.1	2.2	.1	.4	.3	9.7	6.1	.5	3.3
	100%	50%	10%	32%	-	6%	-	1%	1%	25%	16%	1%	8%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. ESTIMATES ARE AS OF DECEMBER 1983. SAMPLE IS 2048 INSTRUMENT SYSTEMS.

NOTE: SUBCATEGORY NUMBERS AND PERCENTAGES MAY NOT SUM EXACTLY TO TOTAL BECAUSE OF ROUNDING. ESTIMATED TOTALS MAY VARY SLIGHTLY FROM TABLE TO TABLE.

SOURCE: NATIONAL SCIENCE FOUNDATION

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TABLE 27. FIELDS RECEIVING FUNDING SUPPORT FOR ACQUISITION OF IN-USE RESEARCH EQUIPMENT, BY SOURCE OF FUNDS [1]

[DOLLARS IN MILLIONS]

	ACQUISITION COST AND PERCENT OF COST												
	SOURCE OF FUNDS												
		FEDERAL								UNIV.	STATE	BUSI-	
	TOTAL	TOTAL	NSF	NIH	DOD	DOE	NASA	USDA	OTHER	FUNDS	GOVT.	NESS	OTHER
TOTAL, SELECTED FIELDS	$1178.1	$640.3	$230.8	$176.5	$103.9	$63.1	$30.8	$5.0	$30.2	$371.5	$61.5	$43.2	$61.5
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
FIELD OF RESEARCH													
ENGINEERING	219.9	106.4	35.1	2.7	45.8	14.4	2.2	.3	5.8	78.5	13.5	13.1	7.4
	19%	17%	15%	2%	44%	23%	7%	7%	19%	21%	22%	30%	12%
AGRICULTURAL SCIENCES	36.1	7.8	1.7	1.3	0	.3	.3	2.7	1.5	17.8	6.7	1.8	2.1
	3%	1%	1%	1%	-	-	1%	54%	5%	5%	11%	4%	3%
BIOLOGICAL SCIENCES, TOTAL	381.3	198.5	35.3	149.7	2.1	3.5	.4	1.9	5.5	131.2	18.6	6.5	26.5
	32%	31%	15%	85%	2%	6%	1%	37%	18%	35%	30%	15%	43%
GRADUATE SCHOOLS	156.1	80.6	24.5	48.9	1.0	.7	.4	1.7	3.5	48.2	13.0	4.3	10.0
	13%	13%	11%	28%	1%	1%	1%	34%	11%	13%	21%	10%	16%
MEDICAL SCHOOLS	225.2	117.9	10.8	100.8	1.2	2.9	0	.2	2.1	83.0	5.5	2.3	16.4
	19%	18%	5%	57%	1%	5%	-	3%	7%	22%	9%	5%	27%
COMPUTER SCIENCE	46.9	21.5	10.8	.3	9.1	.3	0	0	1.0	11.5	4.9	7.7	1.2
	4%	3%	5%	-	9%	-	-	-	3%	3%	8%	18%	2%
ENVIRONMENTAL SCIENCES	92.3	45.7	16.5	.5	6.6	8.2	5.4	0	8.5	27.5	7.2	8.4	3.5
	8%	7%	7%	-	6%	13%	18%	-	28%	7%	12%	19%	6%
MATERIALS SCIENCE	34.1	24.3	13.5	.7	5.4	3.4	0	0	1.3	6.0	2.6	.6	.6
	3%	4%	6%	-	5%	5%	-	-	4%	2%	4%	1%	1%
PHYSICAL SCIENCES	351.9	229.1	116.1	19.5	32.3	33.0	22.7	.1	5.7	92.2	6.6	4.1	20.0
	30%	36%	50%	11%	31%	52%	73%	2%	19%	25%	11%	10%	32%
INTERDISCIPLINARY, N.E.C.	16.6	7.0	1.8	1.9	2.4	0	0	0	.9	6.8	1.5	.9	.4
	1%	1%	1%	1%	2%	-	-	-	3%	2%	2%	2%	1%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. FOR PHASE II FIELDS (AGRICULTURAL, BIOLOGICAL AND ENVIRONMENTAL SCIENCES), ESTIMATES ARE AS OF DECEMBER 1983. FOR ALL OTHER FIELDS, ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 7013 INSTRUMENT SYSTEMS.

NOTE: SUBCATEGORY NUMBERS AND PERCENTAGES MAY NOT SUM EXACTLY TO TOTAL BECAUSE OF ROUNDING. ESTIMATED TOTALS MAY VARY SLIGHTLY FROM TABLE TO TABLE.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 28. ACQUISITION COST OF IN-USE ACADEMIC RESEARCH EQUIPMENT, BY SOURCE OF FUNDS AND BY CONTROL OF INSTITUTION AND SYSTEM PURCHASE PRICE (1)

(DOLLARS IN MILLIONS)

	ACQUISITION COST AND PERCENT OF COST												
	SOURCE OF FUNDS												
		FEDERAL								UNIV.	STATE	BUSI-	
	TOTAL	TOTAL	NSF	NIH	DOD	DOE	NASA	USDA	OTHER	FUNDS	GOVT.	NESS	OTHER
TOTAL, SELECTED FIELDS	$1178.0	$640.3	$230.8	$176.5	$103.9	$63.1	$30.8	$5.0	$30.2	$371.5	$61.5	$43.2	$61.5
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
INSTITUTION CONTROL													
PRIVATE	429.9	268.3	102.8	74.7	53.1	15.2	12.8	.3	9.4	109.9	1.3	24.7	25.7
	36%	42%	45%	42%	51%	24%	42%	6%	31%	30%	2%	57%	42%
PUBLIC	748.1	372.0	128.0	101.8	50.8	47.9	17.9	4.8	20.8	261.7	60.1	18.5	35.9
	64%	58%	55%	58%	49%	76%	58%	94%	69%	70%	98%	43%	58%
SYSTEM PURCHASE PRICE													
$10,000-$24,999	324.9	176.7	43.5	82.6	21.5	14.2	4.9	2.8	7.3	102.7	20.1	8.6	16.8
	28%	28%	19%	47%	21%	22%	16%	56%	24%	28%	33%	20%	27%
$25,000-$74,999	372.6	194.2	68.9	53.2	37.4	15.1	8.6	1.8	9.3	126.2	20.3	13.9	18.0
	32%	30%	30%	30%	36%	24%	28%	36%	31%	34%	33%	32%	29%
$75,000-$1,000,000	480.5	269.4	118.4	40.7	45.0	33.8	17.3	.4	13.6	142.6	21.0	20.7	26.7
	41%	42%	51%	23%	43%	54%	56%	8%	45%	38%	34%	48%	43%

(1) ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. FOR PHASE II FIELDS (AGRICULTURAL, BIOLOGICAL AND ENVIRONMENTAL SCIENCES), ESTIMATES ARE AS OF DECEMBER 1983. FOR ALL OTHER FIELDS, ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 7013 INSTRUMENT SYSTEMS.

NOTE: SUBCATEGORY NUMBERS AND PERCENTAGES MAY NOT SUM EXACTLY TO TOTAL BECAUSE OF ROUNDING. ESTIMATED TOTALS MAY VARY SLIGHTLY FROM TABLE TO TABLE.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 29. FEDERAL INVOLVEMENT IN FUNDING OF IN-USE ACADEMIC RESEARCH INSTRUMENT SYSTEMS, BY FIELD [1]

	PERCENT OF SYSTEMS			
		-FEDERAL FUNDING INVOLVEMENT-		
	TOTAL	NO FUNDING	PARTIAL FUNDING	100% FUNDING
TOTAL, SELECTED FIELDS	100%	38%	18%	44%
FIELD OF RESEARCH				
ENGINEERING	100%	43%	20%	37%
AGRICULTURAL SCIENCES	100%	72%	10%	18%
BIOLOGICAL SCIENCES, TOTAL	100%	40%	12%	49%
GRADUATE SCHOOLS	100%	41%	14%	45%
MEDICAL SCHOOLS	100%	39%	10%	51%
COMPUTER SCIENCE	100%	42%	29%	29%
ENVIRONMENTAL SCIENCES	100%	43%	18%	38%
MATERIALS SCIENCE	100%	13%	32%	55%
PHYSICAL SCIENCES	100%	24%	27%	49%
INTERDISCIPLINARY, N.E.C.	100%	50%	27%	23%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. FOR PHASE II FIELDS (AGRICULTURAL, BIOLOGICAL AND ENVIRONMENTAL SCIENCES), ESTIMATES ARE AS OF DECEMBER 1983. FOR ALL OTHER FIELDS, ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 7013 INSTRUMENT SYSTEMS.

NOTE: SUBCATEGORY PERCENTAGES MAY NOT SUM EXACTLY TO TOTAL BECAUSE OF ROUNDING.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 29A. FEDERAL INVOLVEMENT IN FUNDING OF IN-USE ACADEMIC RESEARCH INSTRUMENT SYSTEMS, BY PHYSICAL SCIENCES AND ENGINEERING SUBFIELD [1]

		PERCENT OF SYSTEMS - FEDERAL FUNDING INVOLVEMENT -		
	TOTAL	NO FUNDING	PARTIAL FUNDING	100% FUNDING
PHYSICAL SCIENCES AND ENGINEERING				
PHYSICAL SCIENCES, TOTAL	100%	24%	27%	49%
CHEMISTRY	100%	35%	32%	34%
PHYSICS AND ASTRONOMY	100%	12%	21%	67%
ENGINEERING, TOTAL	100%	43%	20%	37%
CHEMICAL	100%	34%	22%	43%
CIVIL	100%	73%	20%	7%
ELECTRICAL	100%	19%	18%	63%
MECHANICAL	100%	34%	22%	44%
METALLURGICAL/MATERIALS	100%	43%	33%	24%
OTHER, N.E.C.	100%	69%	10%	20%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES IN THE NATION. ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 2446 INSTRUMENT SYSTEMS.

NOTE: SUBCATEGORY PERCENTAGES MAY NOT SUM EXACTLY TO TOTAL BECAUSE OF ROUNDING.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 29B. FEDERAL INVOLVEMENT IN FUNDING OF IN-USE ACADEMIC RESEARCH INSTRUMENT SYSTEMS, BY AGRICULTURAL AND BIOLOGICAL SCIENCES SUBFIELD [1]

	PERCENT OF SYSTEMS--FEDERAL FUNDING INVOLVEMENT-		
TOTAL	NO FUNDING	PARTIAL FUNDING	100% FUNDING
AGRICULTURAL AND BIOLOGICAL SCIENCES			
AGRICULTURAL SCIENCES, TOTAL	100%	72%	10%	18%
AGRONOMIC SCIENCES	100%	75%	9%	16%
ANIMAL SCIENCES	100%	68%	11%	20%
NATURAL RESOURCE MGMT	100%	63%	11%	26%
BIOLOGICAL SCIENCES, TOTAL	100%	40%	12%	49%
ANATOMY	100%	43%	10%	47%
BIOCHEMISTRY	100%	28%	13%	59%
BOTANY	100%	34%	15%	51%
FOOD AND NUTRITION	100%	70%	9%	21%
MICROBIOLOGY/IMMUNOLOGY	100%	49%	15%	36%
MOLECULAR/CELLULAR BIOLOGY AND GENETICS	100%	45%	9%	46%
PATHOLOGY	100%	54%	7%	39%
PHARMACOLOGY/TOXICOLOGY	100%	41%	8%	51%
PHYSIOLOGY/BIOPHYSICS	100%	35%	14%	51%
ZOOLOGY/ENTOMOLOGY	100%	43%	10%	47%
BIOLOGY, GENERAL AND N.E.C.	100%	42%	15%	43%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. ESTIMATES ARE AS OF DECEMBER 1983. SAMPLE IS 2848 INSTRUMENT SYSTEMS.

NOTE: SUBCATEGORY PERCENTAGES MAY NOT SUM EXACTLY TO TOTAL BECAUSE OF ROUNDING.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 30. RECENT FEDERAL INVOLVEMENT IN FUNDING OF IN-USE ACADEMIC RESEARCH INSTRUMENT SYSTEMS, BY YEAR AND BY FIELD [1]

	PERCENT OF SYSTEMS ACQUIRED PARTLY OR ENTIRELY WITH FEDERAL FUNDS [2]									
	YEAR OF PURCHASE									
	1983	1982	1981	1980	1979	1978	1977	1976	1975	1974
TOTAL, SELECTED FIELDS	45%	55%	63%	66%	62%	65%	62%	63%	62%	63%
FIELD OF RESEARCH										
ENGINEERING	-	58%	69%	58%	55%	50%	60%	45%	28%	59%
AGRICULTURAL SCIENCES	23%	26%	26%	35%	31%	17%	34%	23%	30%	*
BIOLOGICAL SCIENCES, TOTAL	49%	51%	59%	67%	65%	63%	58%	60%	60%	70%
GRADUATE SCHOOLS	36%	32%	36%	63%	65%	61%	51%	68%	59%	64%
MEDICAL SCHOOLS	57%	51%	62%	71%	65%	64%	63%	56%	61%	73%
COMPUTER SCIENCE	-	65%	66%	50%	*	*	*	*	*	*
ENVIRONMENTAL SCIENCES	36%	47%	63%	56%	57%	64%	66%	57%	*	*
MATERIALS SCIENCE	-	*	*	*	*	*	*	*	*	*
PHYSICAL SCIENCES	-	64%	68%	85%	70%	83%	77%	84%	91%	65%
INTERDISCIPLINARY, N.E.C.	*	*	*	*	*	*	*	*	*	*

* INSUFFICIENT SAMPLE: NUMBER OF SYSTEMS IS UNDER 20.

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. FOR PHASE II FIELDS (AGRICULTURAL, BIOLOGICAL AND ENVIRONMENTAL SCIENCES), ESTIMATES ARE AS OF DECEMBER 1983. FOR ALL OTHER FIELDS, ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 5143 INSTRUMENT SYSTEMS.

[2] 1983 FIGURES BASED ON PHASE II FIELDS ONLY.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 31. LOCATION OF IN-USE ACADEMIC RESEARCH INSTRUMENT SYSTEMS, BY FIELD [1]

	NUMBER AND PERCENT OF SYSTEMS					
		LOCATION				
	TOTAL	LAB OF INDIVIDUAL P.I.	NAT'L OR REGIONAL LAB	NONDEPARTMENTAL FACILITY	DEPARTMENT MANAGED COMMON LAB	OTHER SHARED ACCESS
TOTAL, SELECTED FIELDS	36212	21390	484	2340	11466	532
	100%	59%	1%	6%	32%	1%
FIELD OF RESEARCH						
ENGINEERING	6777	3412	56	430	2673	205
	100%	50%	1%	6%	39%	3%
AGRICULTURAL SCIENCES	1631	1037	12	61	504	18
	100%	64%	1%	4%	31%	1%
BIOLOGICAL SCIENCES, TOTAL	15016	9739	108	483	4641	45
	100%	65%	1%	3%	31%	-
GRADUATE SCHOOLS	6353	4168	62	223	1871	29
	100%	66%	1%	4%	29%	-
MEDICAL SCHOOLS	8663	5571	46	260	2770	16
	100%	64%	1%	3%	32%	-
COMPUTER SCIENCE	878	170	2	122	573	11
	100%	19%	-	14%	65%	1%
MATERIALS SCIENCE	642	121	37	309	176	0
	100%	19%	6%	48%	27%	-
ENVIRONMENTAL SCIENCES	2083	1080	36	280	580	88
	100%	52%	3%	13%	28%	4%
PHYSICAL SCIENCES	8731	5708	196	546	2118	163
	100%	65%	2%	6%	24%	2%
INTERDISCIPLINARY, N.E.C.	454	124	17	109	203	2
	100%	27%	4%	24%	45%	-

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. FOR PHASE II FIELDS (AGRICULTURAL, BIOLOGICAL AND ENVIRONMENTAL SCIENCES), ESTIMATES ARE AS OF DECEMBER 1983. FOR ALL OTHER FIELDS, ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 7013 INSTRUMENT SYSTEMS.

NOTE: SUBCATEGORY NUMBERS AND PERCENTAGES MAY NOT SUM EXACTLY TO TOTAL BECAUSE OF ROUNDING. ESTIMATED TOTALS MAY VARY SLIGHTLY FROM TABLE TO TABLE.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 31A. LOCATION OF IN-USE ACADEMIC RESEARCH INSTRUMENT SYSTEMS, BY PHYSICAL SCIENCES AND ENGINEERING SUBFIELD [1]

	NUMBER AND PERCENT OF SYSTEMS					
		LOCATION				
	TOTAL	LAB OF INDIVIDUAL P.I.	NAT'L OR REGIONAL LAB	NONDEPARTMENTAL FACILITY	DEPARTMENT MANAGED COMMON LAB	OTHER SHARED ACCESS
PHYSICAL SCIENCES AND ENGINEERING						
PHYSICAL SCIENCES, TOTAL	8731	5708	196	346	2118	163
	100%	65%	2%	4%	24%	2%
CHEMISTRY	4848	3017	92	201	1478	62
	100%	62%	2%	4%	30%	1%
PHYSICS AND ASTRONOMY	3883	2691	104	345	642	101
	100%	69%	3%	9%	17%	3%
ENGINEERING, TOTAL	6777	3412	56	430	2673	205
	100%	50%	1%	6%	39%	3%
CHEMICAL	673	500	0	11	151	11
	100%	74%	-	2%	22%	2%
CIVIL	395	186	2	0	201	6
	100%	47%	-	-	51%	2%
ELECTRICAL	1504	1017	28	141	298	20
	100%	68%	2%	9%	20%	1%
MECHANICAL	1341	586	11	132	585	26
	100%	44%	1%	10%	44%	2%
METALLURGICAL/MATERIALS	1088	600	13	81	333	61
	100%	55%	1%	7%	31%	6%
OTHER, N.E.C.	1776	523	2	64	1106	81
	100%	29%	-	4%	62%	5%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES IN THE NATION. ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 2446 INSTRUMENT SYSTEMS.

NOTE: SUBCATEGORY NUMBERS AND PERCENTAGES MAY NOT SUM EXACTLY TO TOTAL BECAUSE OF ROUNDING. ESTIMATED TOTALS MAY VARY SLIGHTLY FROM TABLE TO TABLE.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 31B. LOCATION OF IN-USE ACADEMIC RESEARCH INSTRUMENT SYSTEMS, BY AGRICULTURAL AND BIOLOGICAL SCIENCES SUBFIELD [1]

	NUMBER AND PERCENT OF SYSTEMS					
		LOCATION				
	TOTAL	LAB OF INDIVIDUAL P.I.	NAT'L OR REGIONAL LAB	NONDEPARTMENTAL FACILITY	DEPARTMENT MANAGED COMMON LAB	OTHER SHARED ACCESS
AGRICULTURAL AND BIOLOGICAL SCIENCES						
AGRICULTURAL SCIENCES, TOTAL	1631	1037	12	61	504	18
	100%	64%	1%	4%	31%	1%
AGRONOMIC SCIENCES	1029	712	9	30	262	16
	100%	69%	1%	3%	25%	2%
ANIMAL SCIENCES	420	255	2	15	149	0
	100%	61%	-	3%	36%	-
NATURAL RESOURCE MGMT	181	69	2	16	92	2
	100%	38%	1%	9%	51%	1%
BIOLOGICAL SCIENCES, TOTAL	15016	9739	108	483	4641	45
	100%	65%	1%	3%	31%	-
ANATOMY	461	231	1	28	201	0
	100%	50%	-	6%	44%	-
BIOCHEMISTRY	3683	2566	34	76	1007	0
	100%	70%	1%	2%	27%	-
BOTANY	437	243	28	16	148	3
	100%	56%	6%	4%	34%	1%
FOOD AND NUTRITION	380	193	0	0	182	2
	100%	51%	-	-	48%	1%
MICROBIOLOGY/IMMUNOLOGY	1249	648	6	61	527	5
	100%	52%	1%	5%	42%	-
MOLECULAR/CELLULAR BIOLOGY AND GENETICS	2727	1855	6	71	789	6
	100%	68%	-	3%	29%	-
PATHOLOGY	760	432	0	13	287	8
	100%	59%	-	2%	38%	1%
PHARMACOLOGY/TOXICOLOGY	1645	1145	3	59	438	0
	100%	70%	-	4%	27%	-
PHYSIOLOGY/BIOPHYSICS	1983	1407	17	57	491	11
	100%	71%	1%	3%	25%	1%
ZOOLOGY/ENTOMOLOGY	422	303	0	2	117	0
	100%	72%	-	-	28%	-
BIOLOGY, GENERAL AND N.E.C.	1269	694	12	101	453	9
	100%	55%	1%	8%	36%	1%

[1] ALL STATICICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. ESTIMATES ARE AS OF DECEMBER 1983. SAMPLE IS 2848 INSTRUMENT SYSTEMS.

NOTE: SUBCATEGORY NUMBERS AND PERCENTAGES MAY NOT SUM EXACTLY TO TOTAL BECAUSE OF ROUNDING. ESTIMATED TOTALS MAY VARY SLIGHTLY FROM TABLE TO TABLE.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 32. PERCENT OF IN-USE ACADEMIC RESEARCH INSTRUMENT SYSTEMS LOCATED IN SHARED-ACCESS FACILITIES, BY RESEARCH STATUS AND BY FIELD [1]

	PERCENT OF SYSTEMS IN SHARED-ACCESS FACILITIES		
		RESEARCH STATUS	
	TOTAL	STATE-OF-THE-ART SYSTEMS	OTHER SYSTEMS IN RESEARCH USE
TOTAL, SELECTED FIELDS	41%	38%	42%
FIELD OF RESEARCH			
ENGINEERING	50%	50%	49%
AGRICULTURAL SCIENCES	36%	31%	38%
BIOLOGICAL SCIENCES, TOTAL	35%	32%	36%
GRADUATE SCHOOLS	34%	29%	36%
MEDICAL SCHOOLS	36%	35%	36%
COMPUTER SCIENCE	81%	73%	83%
ENVIRONMENTAL SCIENCES	48%	46%	49%
MATERIALS SCIENCE	81%	73%	83%
PHYSICAL SCIENCES	35%	27%	37%
INTERDISCIPLINARY, N.E.C.	73%	84%	68%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. FOR PHASE II FIELDS (AGRICULTURAL, BIOLOGICAL AND ENVIRONMENTAL SCIENCES), ESTIMATES ARE AS OF DECEMBER 1983. FOR ALL OTHER FIELDS, ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 7013 INSTRUMENT SYSTEMS.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 32A. PERCENT OF IN-USE ACADEMIC RESEARCH INSTRUMENT SYSTEMS LOCATED IN SHARED-ACCESS FACILITIES, BY RESEARCH STATUS AND BY PHYSICAL SCIENCES AND ENGINEERING SUBFIELD [1]

	PERCENT OF SYSTEMS IN SHARED-ACCESS FACILITIES		
		RESEARCH STATUS	
	TOTAL	STATE-OF-THE-ART SYSTEMS	OTHER SYSTEMS IN RESEARCH USE
PHYSICAL SCIENCES AND ENGINEERING			
PHYSICAL SCIENCES, TOTAL	35%	27%	37%
CHEMISTRY	38%	31%	39%
PHYSICS AND ASTRONOMY	31%	22%	33%
ENGINEERING, TOTAL	50%	50%	49%
CHEMICAL	26%	29%	25%
CIVIL	53%	45%	55%
ELECTRICAL	32%	24%	35%
MECHANICAL	56%	41%	62%
METALLURGICAL/MATERIALS	45%	34%	47%
OTHER, N.E.C.	71%	86%	64%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES IN THE NATION. ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 2446 INSTRUMENT SYSTEMS.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 32B. PERCENT OF IN-USE ACADEMIC RESEARCH INSTRUMENT SYSTEMS LOCATED IN SHARED-ACCESS FACILITIES, BY RESEARCH STATUS AND BY AGRICULTURAL AND BIOLOGICAL SCIENCES SUBFIELD [1]

	PERCENT OF SYSTEMS IN SHARED-ACCESS FACILITIES		
		RESEARCH STATUS	
	TOTAL	STATE-OF-THE-ART SYSTEMS	OTHER SYSTEMS IN RESEARCH USE
AGRICULTURAL AND BIOLOGICAL SCIENCES			
AGRICULTURAL SCIENCES, TOTAL	36%	31%	38%
AGRONOMIC SCIENCES	31%	28%	32%
ANIMAL SCIENCES	39%	33%	41%
NATURAL RESOURCE MGMT	62%	57%	63%
BIOLOGICAL SCIENCES, TOTAL	35%	32%	36%
ANATOMY	50%	43%	53%
BIOCHEMISTRY	30%	26%	31%
BOTANY	44%	24%	51%
FOOD AND NUTRITION	49%	53%	48%
MICROBIOLOGY/IMMUNOLOGY	48%	53%	47%
MOLECULAR/CELLULAR BIOLOGY AND GENETICS	32%	32%	32%
PATHOLOGY	41%	34%	42%
PHARMACOLOGY/TOXICOLOGY	30%	32%	30%
PHYSIOLOGY/BIOPHYSICS	29%	30%	29%
ZOOLOGY/ENTOMOLOGY	28%	26%	29%
BIOLOGY, GENERAL AND N.E.C.	45%	32%	49%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 137 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. ESTIMATES ARE AS OF DECEMBER 1983. SAMPLE IS 2848 INSTRUMENT SYSTEMS.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 33. PERCENT OF IN-USE ACADEMIC RESEARCH INSTRUMENT SYSTEMS LOCATED IN SHARED-ACCESS FACILITIES, BY SYSTEM PURCHASE PRICE AND BY FIELD (1)

	PERCENT OF SYSTEMS IN SHARED-ACCESS FACILITIES			
		SYSTEM PURCHASE PRICE		
	TOTAL	$10,000-$24,999	$25,000-$74,999	$75,000-$1,000,000
TOTAL, SELECTED FIELDS	41%	36%	44%	60%
FIELD OF RESEARCH				
ENGINEERING	50%	48%	50%	59%
AGRICULTURAL SCIENCES	36%	37%	34%	54%
BIOLOGICAL SCIENCES, TOTAL	35%	31%	40%	63%
GRADUATE SCHOOLS	34%	31%	38%	70%
MEDICAL SCHOOLS	36%	32%	41%	60%
COMPUTER SCIENCE	81%	87%	68%	90%
ENVIRONMENTAL SCIENCES	48%	42%	54%	55%
MATERIALS SCIENCE	81%	80%	82%	82%
PHYSICAL SCIENCES	35%	27%	38%	54%
INTERDISCIPLINARY, N.E.C.	73%	66%	80%	94%

(1) ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. FOR PHASE II FIELDS (AGRICULTURAL, BIOLOGICAL AND ENVIRONMENTAL SCIENCES), ESTIMATES ARE AS OF DECEMBER 1983. FOR ALL OTHER FIELDS, ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 7013 INSTRUMENT SYSTEMS.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 33A. PERCENT OF IN-USE ACADEMIC RESEARCH INSTRUMENT SYSTEMS LOCATED IN SHARED-ACCESS FACILITIES, BY SYSTEM PURCHASE PRICE AND BY PHYSICAL SCIENCES AND ENGINEERING SUBFIELD (1)

	PERCENT OF SYSTEMS IN SHARED-ACCESS FACILITIES			
		SYSTEM PURCHASE PRICE		
	TOTAL	$10,000-$24,999	$25,000-$74,999	$75,000-$1,000,000
PHYSICAL SCIENCES AND ENGINEERING				
PHYSICAL SCIENCES, TOTAL	35%	27%	38%	54%
CHEMISTRY	38%	29%	40%	66%
PHYSICS AND ASTRONOMY	31%	24%	36%	38%
ENGINEERING, TOTAL	50%	48%	50%	59%
CHEMICAL	26%	26%	23%	33%
CIVIL	53%	50%	56%	61%
ELECTRICAL	32%	29%	31%	52%
MECHANICAL	56%	56%	60%	46%
METALLURGICAL/MATERIALS	45%	37%	48%	74%
OTHER, N.E.C.	71%	69%	73%	73%

(1) ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES IN THE NATION. ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 2446 INSTRUMENT SYSTEMS.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 339. PERCENT OF IN-USE ACADEMIC RESEARCH INSTRUMENT SYSTEMS LOCATED IN SHARED-ACCESS FACILITIES, BY SYSTEM PURCHASE PRICE AND BY AGRICULTURAL AND BIOLOGICAL SCIENCES SUBFIELD [1]

	PERCENT OF SYSTEMS IN SHARED-ACCESS FACILITIES			
		SYSTEM PURCHASE PRICE		
	TOTAL	$10,000-$24,999	$25,000-$74,999	$75,000-$1,000,000
AGRICULTURAL AND BIOLOGICAL SCIENCES				
AGRICULTURAL SCIENCES, TOTAL	36%	37%	34%	54%
AGRONOMIC SCIENCES	31%	30%	30%	55%
ANIMAL SCIENCES	39%	39%	39%	33%
NATURAL RESOURCE MGMT	62%	67%	43%	64%
BIOLOGICAL SCIENCES, TOTAL	35%	31%	40%	63%
ANATOMY	50%	38%	63%	72%
BIOCHEMISTRY	30%	29%	31%	45%
BOTANY	44%	40%	42%	100%
FOOD AND NUTRITION	49%	51%	43%	37%
MICROBIOLOGY/IMMUNOLOGY	48%	44%	57%	61%
MOLECULAR/CELLULAR BIOLOGY AND GENETICS	32%	27%	35%	75%
PATHOLOGY	41%	24%	64%	67%
PHARMACOLOGY/TOXICOLOGY	30%	30%	29%	41%
PHYSIOLOGY/BIOPHYSICS	29%	27%	31%	46%
ZOOLOGY/ENTOMOLOGY	28%	21%	38%	53%
BIOLOGY, GENERAL AND N.E.C.	45%	38%	52%	87%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. ESTIMATES ARE AS OF DECEMBER 1983. SAMPLE IS 2848 INSTRUMENT SYSTEMS.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 34. PERCENT OF IN-USE ACADEMIC RESEARCH INSTRUMENT SYSTEMS LOCATED IN SHARED-ACCESS FACILITIES, BY SYSTEM AGE AND BY FIELD [1]

	PERCENT OF SYSTEMS IN SHARED-ACCESS FACILITIES			
		SYSTEM AGE (FROM YR OF PURCHASE)[2]		
	TOTAL	1-5 YEARS	6-10 YEARS	OVER 10 YEARS
TOTAL, SELECTED FIELDS	41%	38%	41%	48%
FIELD OF RESEARCH				
ENGINEERING	50%	41%	51%	73%
AGRICULTURAL SCIENCES	36%	38%	36%	32%
BIOLOGICAL SCIENCES, TOTAL	35%	31%	35%	42%
GRADUATE SCHOOLS	34%	30%	37%	41%
MEDICAL SCHOOLS	36%	33%	34%	44%
COMPUTER SCIENCE	81%	80%	87%	100%
ENVIRONMENTAL SCIENCES	48%	51%	48%	40%
MATERIALS SCIENCE	81%	75%	68%	90%
PHYSICAL SCIENCES	35%	31%	40%	37%
INTERDISCIPLINARY, N.E.C.	73%	67%	78%	73%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. FOR PHASE II FIELDS (AGRICULTURAL, BIOLOGICAL AND ENVIRONMENTAL SCIENCES), ESTIMATES ARE AS OF DECEMBER 1983. FOR ALL OTHER FIELDS, ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 7013 INSTRUMENT SYSTEMS.

[2] FOR PHASE II FIELDS, AGE INTERVALS ARE 1-5 YEARS (1979-83); 6-10 YEARS (1974-78); OVER 10 YEARS (1973 OR BEFORE). FOR PHASE I FIELDS INTERVALS ARE 1-5 YEARS (1978-82); 6-10 YEARS (1973-77); OVER 10 YEARS (1972 OR BEFORE).

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 34A. PERCENT OF IN-USE ACADEMIC RESEARCH INSTRUMENT SYSTEMS LOCATED IN SHARED-ACCESS FACILITIES, BY SYSTEM AGE AND BY PHYSICAL SCIENCES AND ENGINEERING SUBFIELD [1]

	PERCENT OF SYSTEMS IN SHARED-ACCESS FACILITIES			
		SYSTEM AGE (FROM YR OF PURCHASE)[2]		
	TOTAL	1-5 YEARS	6-10 YEARS	OVER 10 YEARS
PHYSICAL SCIENCES AND ENGINEERING				
PHYSICAL SCIENCES, TOTAL	35%	31%	40%	37%
CHEMISTRY	38%	36%	43%	36%
PHYSICS AND ASTRONOMY	31%	24%	35%	37%
ENGINEERING, TOTAL	50%	41%	51%	73%
CHEMICAL	26%	28%	19%	25%
CIVIL	53%	50%	54%	57%
ELECTRICAL	32%	30%	40%	40%
MECHANICAL	56%	48%	37%	80%
METALLURGICAL/MATERIALS	43%	29%	58%	85%
OTHER, N.E.C.	71%	63%	67%	85%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES IN THE NATION. ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 2446 INSTRUMENT SYSTEMS.

[2] AGE INTERVALS ARE 1-5 YEARS (1978-82); 6-10 YEARS (1973-77); OVER 10 YEARS (1972 OR BEFORE).

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 34B. PERCENT OF IN-USE ACADEMIC RESEARCH INSTRUMENT SYSTEMS LOCATED IN SHARED-ACCESS FACILITIES, BY SYSTEM AGE AND BY AGRICULTURAL AND BIOLOGICAL SCIENCES SUBFIELD [1]

	PERCENT OF SYSTEMS IN SHARED-ACCESS FACILITIES			
		SYSTEM AGE (FROM YR OF PURCHASE)[2]		
	TOTAL	1-5 YEARS	6-10 YEARS	OVER 10 YEARS
AGRICULTURAL AND BIOLOGICAL SCIENCES				
AGRICULTURAL SCIENCES, TOTAL	36%	38%	36%	32%
AGRONOMIC SCIENCES	31%	30%	34%	27%
ANIMAL SCIENCES	39%	42%	36%	35%
NATURAL RESOURCE MGMT	62%	62%	60%	63%
BIOLOGICAL SCIENCES, TOTAL	35%	31%	35%	42%
ANATOMY	50%	49%	51%	50%
BIOCHEMISTRY	30%	31%	25%	35%
BOTANY	44%	32%	64%	57%
FOOD AND NUTRITION	49%	48%	42%	58%
MICROBIOLOGY/IMMUNOLOGY	48%	37%	49%	64%
MOLECULAR/CELLULAR BIOLOGY AND GENETICS	32%	27%	36%	38%
PATHOLOGY	41%	39%	38%	47%
PHARMACOLOGY/TOXICOLOGY	30%	28%	25%	41%
PHYSIOLOGY/BIOPHYSICS	29%	27%	27%	37%
ZOOLOGY/ENTOMOLOGY	28%	22%	36%	44%
BIOLOGY, GENERAL AND N.E.C.	45%	39%	51%	48%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. ESTIMATES ARE AS OF DECEMBER 1983. SAMPLE IS 2848 INSTRUMENT SYSTEMS.

[2] AGE INTERVALS ARE 1-5 YEARS (1979-83); 6-10 YEARS (1974-78); OVER 10 YEARS (1973 OR BEFORE).

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 35. EXPERIMENTAL ROLE OF IN-USE ACADEMIC RESEARCH INSTRUMENT SYSTEMS, BY FIELD (1)

	-----NUMBER AND PERCENT OF SYSTEMS---- ----EXPERIMENTAL ROLE----		
	TOTAL	DEDICATED	GENERAL PURPOSE
TOTAL, SELECTED FIELDS	35768	9754	26014
	100%	27%	73%
FIELD OF RESEARCH			
ENGINEERING	6724	2478	4246
	100%	37%	63%
AGRICULTURAL SCIENCES	1602	380	1222
	100%	24%	76%
BIOLOGICAL SCIENCES, TOTAL	14760	2495	12265
	100%	17%	83%
GRADUATE SCHOOLS	6212	878	5334
	100%	14%	86%
MEDICAL SCHOOLS	8548	1617	6931
	100%	19%	81%
COMPUTER SCIENCE	866	144	722
	100%	17%	83%
ENVIRONMENTAL SCIENCES	2103	689	1414
	100%	33%	67%
MATERIALS SCIENCE	637	131	506
	100%	21%	79%
PHYSICAL SCIENCES	8630	3375	5255
	100%	39%	61%
INTERDISCIPLINARY, N.E.C.	445	62	383
	100%	14%	86%

(1) ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 137 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. FOR PHASE II FIELDS (AGRICULTURAL, BIOLOGICAL AND ENVIRONMENTAL SCIENCES), ESTIMATES ARE AS OF DECEMBER 1983. FOR ALL OTHER FIELDS, ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 7013 INSTRUMENT SYSTEMS.

NOTE: SUBCATEGORY NUMBERS AND PERCENTAGES MAY NOT SUM EXACTLY TO TOTAL BECAUSE OF ROUNDING. ESTIMATED TOTALS MAY VARY SLIGHTLY FROM TABLE TO TABLE.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 35A. EXPERIMENTAL ROLE OF IN-USE ACADEMIC RESEARCH INSTRUMENT SYSTEMS, BY PHYSICAL SCIENCES AND ENGINEERING SUBFIELD [1]

	----NUMBER AND PERCENT OF SYSTEMS----- ----EXPERIMENTAL ROLE---- TOTAL	DEDICATED	GENERAL PURPOSE
PHYSICAL SCIENCES AND ENGINEERING			
PHYSICAL SCIENCES, TOTAL	8630	3375	5255
	100%	39%	61%
CHEMISTRY	4751	1495	3256
	100%	31%	69%
PHYSICS AND ASTRONOMY	3879	1879	2000
	100%	48%	52%
ENGINEERING, TOTAL	6724	2478	4246
	100%	37%	63%
CHEMICAL	676	351	325
	100%	52%	48%
CIVIL	395	82	313
	100%	21%	79%
ELECTRICAL	1489	661	828
	100%	44%	56%
MECHANICAL	1313	573	740
	100%	44%	56%
METALLURGICAL/MATERIALS	1084	333	751
	100%	31%	69%
OTHER, N.E.C.	1769	484	1289
	100%	27%	73%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES IN THE NATION. ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 2446 INSTRUMENT SYSTEMS.

NOTE: SUBCATEGORY NUMBERS AND PERCENTAGES MAY NOT SUM EXACTLY TO TOTAL BECAUSE OF ROUNDING. ESTIMATED TOTALS MAY VARY SLIGHTLY FROM TABLE TO TABLE.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 35B. EXPERIMENTAL ROLE OF IN-USE ACADEMIC RESEARCH INSTRUMENT SYSTEMS, BY AGRICULTURAL AND BIOLOGICAL SCIENCES SUBFIELD [1]

	----NUMBER AND PERCENT OF SYSTEMS----- ----EXPERIMENTAL ROLE----		
	TOTAL	DEDICATED	GENERAL PURPOSE
AGRICULTURAL AND BIOLOGICAL SCIENCES			
AGRICULTURAL SCIENCES, TOTAL	1602	380	1222
	100%	24%	76%
AGRONOMIC SCIENCES	1007	251	756
	100%	25%	75%
ANIMAL SCIENCES	416	65	351
	100%	16%	84%
NATURAL RESOURCE MGMT	179	63	116
	100%	35%	65%
BIOLOGICAL SCIENCES, TOTAL	14760	2495	12265
	100%	17%	83%
ANATOMY	450	86	364
	100%	19%	81%
BIOCHEMISTRY	3618	456	3162
	100%	13%	87%
BOTANY	414	57	357
	100%	14%	86%
FOOD AND NUTRITION	369	85	284
	100%	23%	77%
MICROBIOLOGY/IMMUNOLOGY	1252	71	1181
	100%	6%	94%
MOLECULAR/CELLULAR BIOLOGY AND GENETICS	2658	259	2399
	100%	10%	90%
PATHOLOGY	742	78	664
	100%	11%	89%
PHARMACOLOGY/TOXICOLOGY	1623	427	1196
	100%	26%	74%
PHYSIOLOGY/BIOPHYSICS	1965	641	1324
	100%	33%	67%
ZOOLOGY/ENTOMOLOGY	413	91	322
	100%	22%	78%
BIOLOGY, GENERAL AND N.E.C.	1257	244	1013
	100%	19%	81%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. ESTIMATES ARE AS OF DECEMBER 1983. SAMPLE IS 2848 INSTRUMENT SYSTEMS.

NOTE: SUBCATEGORY NUMBERS AND PERCENTAGES MAY NOT SUM EXACTLY TO TOTAL BECAUSE OF ROUNDING. ESTIMATED TOTALS MAY VARY SLIGHTLY FROM TABLE TO TABLE.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 36. MEAN NUMBER OF RESEARCH USERS OF IN-USE ACADEMIC RESEARCH INSTRUMENT SYSTEMS, BY EXPERIMENTAL ROLE AND BY FIELD [1]

	MEAN NUMBER OF RESEARCH USERS		
		EXPERIMENTAL ROLE	
	TOTAL	DEDICATED	GENERAL PURPOSE
TOTAL, SELECTED FIELDS	14.3	8.2	16.5
FIELD OF RESEARCH			
ENGINEERING	14.1	9.8	16.6
AGRICULTURAL SCIENCES	11.0	6.9	12.1
BIOLOGICAL SCIENCES, TOTAL	11.5	7.0	12.4
GRADUATE SCHOOLS	12.4	7.7	13.1
MEDICAL SCHOOLS	10.8	6.6	11.8
COMPUTER SCIENCE	59.2	21.4	65.4
ENVIRONMENTAL SCIENCES	12.4	6.5	15.2
MATERIALS SCIENCE	34.4	12.3	40.0
PHYSICAL SCIENCES	15.5	7.7	20.6
INTERDISCIPLINARY, N.E.C.	15.0	17.6	14.7

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 137 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. FOR PHASE II FIELDS (AGRICULTURAL, BIOLOGICAL AND ENVIRONMENTAL SCIENCES), ESTIMATES ARE OF USERS IN 1983. FOR ALL OTHER FIELDS, ESTIMATES ARE OF USERS IN 1982. SAMPLE IS 7013 INSTRUMENT SYSTEMS.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 36A. MEAN NUMBER OF RESEARCH USERS OF IN-USE ACADEMIC RESEARCH INSTRUMENT SYSTEMS, BY EXPERIMENTAL ROLE AND BY PHYSICAL SCIENCES AND ENGINEERING SUBFIELD [1]

	----MEAN NUMBER OF RESEARCH USERS----- ----EXPERIMENTAL ROLE----		
	TOTAL	DEDICATED	GENERAL PURPOSE
PHYSICAL SCIENCES AND ENGINEERING			
PHYSICAL SCIENCES, TOTAL	15.5	7.7	20.6
CHEMISTRY	19.0	8.7	23.8
PHYSICS AND ASTRONOMY	11.1	6.8	15.1
ENGINEERING, TOTAL	14.1	9.8	16.6
CHEMICAL	6.4	3.6	9.6
CIVIL	13.4	3.9	16.1
ELECTRICAL	20.5	17.6	22.7
MECHANICAL	11.3	4.9	16.0
METALLURGICAL/MATERIALS	11.0	7.0	12.8
OTHER, N.E.C.	15.8	12.2	17.1

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES IN THE NATION. ESTIMATES ARE OF USERS DURING 1982. SAMPLE IS 2446 INSTRUMENT SYSTEMS.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 36B. MEAN NUMBER OF RESEARCH USERS OF IN-USE ACADEMIC RESEARCH INSTRUMENT SYSTEMS, BY EXPERIMENTAL ROLE AND BY AGRICULTURAL AND BIOLOGICAL SCIENCES SUBFIELD [1]

	----MEAN NUMBER OF RESEARCH USERS---- ----EXPERIMENTAL ROLE----		
	TOTAL	DEDICATED	GENERAL PURPOSE
AGRICULTURAL AND BIOLOGICAL SCIENCES			
AGRICULTURAL SCIENCES, TOTAL	11.0	6.9	12.1
AGRONOMIC SCIENCES	10.0	6.9	11.0
ANIMAL SCIENCES	13.1	8.4	14.0
NATURAL RESOURCE MGMT	10.8	5.5	13.6
BIOLOGICAL SCIENCES, TOTAL	11.5	7.0	12.4
ANATOMY	10.2	7.0	10.9
BIOCHEMISTRY	11.5	6.3	12.2
BOTANY	12.8	6.3	13.7
FOOD AND NUTRITION	11.3	8.7	12.1
MICROBIOLOGY/IMMUNOLOGY	14.7	7.7	15.1
MOLECULAR/CELLULAR BIOLOGY AND GENETICS	12.1	10.5	12.3
PATHOLOGY	11.7	15.2	11.3
PHARMACOLOGY/TOXICOLOGY	9.2	6.3	10.2
PHYSIOLOGY/BIOPHYSICS	9.8	5.7	11.7
ZOOLOGY/ENTOMOLOGY	8.0	5.7	8.6
BIOLOGY, GENERAL AND N.E.C.	14.0	6.6	15.6

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. ESTIMATES ARE OF USERS DURING 1983. SAMPLE IS 2848 INSTRUMENTS SYSTEMS.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 37. MEAN NUMBER OF RESEARCH USERS OF IN-USE ACADEMIC RESEARCH INSTRUMENT SYSTEMS, BY EXPERIMENTAL ROLE AND BY OTHER SYSTEM CHARACTERISTICS [1]

	----MEAN NUMBER OF RESEARCH USERS----- ----EXPERIMENTAL ROLE----		
	TOTAL	DEDICATED	GENERAL PURPOSE
TOTAL, SELECTED FIELDS	14.3	8.2	16.5
RESEARCH STATUS			
STATE-OF-THE-ART	13.2	8.6	15.5
OTHER	14.6	8.1	16.7
PURCHASE PRICE			
$10,000-$24,999	12.3	7.6	13.9
$25,000-$74,999	14.2	8.0	16.8
$75,000-$1,000,000	27.2	12.8	32.5
AGE (FROM YR OF PURCHASE) [2]			
1-5 YEARS	15.8	9.2	18.6
6-10 YEARS	13.3	7.0	15.2
OVER 10 YEARS	11.6	6.2	13.2
CONDITION			
EXCELLENT	14.9	8.8	17.2
AVERAGE	13.6	7.8	15.5
POOR	13.4	6.0	16.5
LOCATION			
WITHIN-DEPT LAB OF P.I.	8.9	7.1	9.9
SHARED-ACESSS FACILITY	21.8	12.5	23.4

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. FOR PHASE II FIELDS (AGRICULTURAL, BIOLOGICAL AND ENVIRONMENTAL SCIENCES), ESTIMATES ARE FOR CALENDAR 1983. FOR ALL OTHER FIELDS, ESTIMATES ARE FOR CALENDAR 1982. SAMPLE IS 7013 INSTRUMENT SYSTEMS.

[2] FOR PHASE II FIELDS, AGE INTERVALS ARE 1-5 YEARS (1979-83); 6-10 YEARS (1974-78; OVER 10 YEARS (1973 OR BEFORE). FOR PHASE I FIELDS INTEVALS ARE 1-5 YEARS (1978-82); 6-10 YEARS (1973-77); OVER 10 YEARS (1972 OR BEFORE).

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 38. TYPES OF RESEARCH USERS OF IN-USE ACADEMIC RESEARCH INSTRUMENT SYSTEMS, BY RESEARCH STATUS AND BY SYSTEM PURCHASE PRICE [1]

	PERCENT OF IN-USE SYSTEMS USED BY				
	FACULTY, THIS DEPT./ FACILITY	GRADUATE AND MEDICAL STUDENTS AND POST DOCS., THIS DEPT./ FACILITY	RESEARCHERS FROM OTHER DEPTS. THIS INSTITUTION	RESEARCHERS FROM OTHER UNIVERSITIES	NONACADEMIC RESEARCHERS
TOTAL, SELECTED FIELDS	92%	85%	34%	12%	12%
RESEARCH STATUS					
STATE-OF-THE-ART	94%	82%	30%	15%	15%
OTHER	91%	85%	35%	12%	11%
SYSTEM PURCHASE PRICE					
$10,000-$24,999	91%	85%	31%	8%	9%
$25,000-$74,999	92%	83%	35%	13%	13%
$75,000-$1,000,000	95%	88%	49%	31%	22%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. FOR PHASE II FIELDS (AGRICULTURAL, BIOLOGICAL AND ENVIRONMENTAL SCIENCES), ESTIMATES ARE OF USERS IN 1983. FOR ALL OTHER FIELDS, ESTIMATES ARE OF USERS IN 1982. SAMPLE IS 7013 INSTRUMENT SYSTEMS.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 39. TYPES OF RESEARCH USERS OF IN-USE ACADEMIC RESEARCH INSTRUMENT SYSTEMS, BY FIELD [1]

	PERCENT OF IN-USE SYSTEMS USED BY				
	FACULTY, THIS DEPT./ FACILITY	GRADUATE AND MEDICAL STUDENTS AND POST DOCS., THIS DEPT./ FACILITY	RESEARCHERS FROM OTHER DEPTS. THIS INSTITUTION	RESEARCHERS FROM OTHER UNIVERSITIES	NONACADEMIC RESEARCHERS
TOTAL, SELECTED FIELDS	92%	85%	34%	12%	12%
FIELD OF RESEARCH					
ENGINEERING	91%	80%	28%	7%	11%
AGRICULTURAL SCIENCES	94%	84%	46%	6%	10%
BIOLOGICAL SCIENCES, TOTAL	95%	86%	36%	9%	13%
GRADUATE SCHOOLS	95%	87%	33%	9%	13%
MEDICAL SCHOOLS	95%	85%	38%	9%	13%
COMPUTER SCIENCE	90%	90%	54%	10%	9%
ENVIRONMENTAL SCIENCES	92%	81%	29%	31%	18%
MATERIALS SCIENCE	64%	66%	57%	8%	13%
PHYSICAL SCIENCES	89%	89%	28%	19%	9%
INTERDISCIPLINARY, N.E.C.	97%	73%	50%	12%	12%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 137 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. FOR PHASE II FIELDS (AGRICULTURAL, BIOLOGICAL AND ENVIRONMENTAL SCIENCES), ESTIMATES ARE OF USERS DURING 1983. FOR ALL OTHER FIELDS, ESTIMATES ARE OF USERS DURING 1982. SAMPLE IS 7013 INSTRUMENT SYSTEMS.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 39A. TYPES OF RESEARCH USERS OF IN-USE ACADEMIC RESEARCH INSTRUMENT SYSTEMS, BY PHYSICAL SCIENCES AND ENGINEERING SUBFIELD [1]

	PERCENT OF IN-USE SYSTEMS USED BY				
	FACULTY, THIS DEPT./ FACILITY	GRADUATE AND MEDICAL STUDENTS AND POST DOCS., THIS DEPT./ FACILITY	RESEARCHERS FROM OTHER DEPTS. THIS INSTITUTION	RESEARCHERS FROM OTHER UNIVERSITIES	NONACADEMIC RESEARCHERS
PHYSICAL SCIENCES AND ENGINEERING					
PHYSICAL SCIENCES, TOTAL	89%	89%	28%	19%	9%
CHEMISTRY	88%	91%	30%	20%	10%
PHYSICS AND ASTRONOMY	91%	86%	26%	17%	8%
ENGINEERING, TOTAL	91%	80%	28%	7%	11%
CHEMICAL	78%	79%	26%	5%	2%
CIVIL	86%	88%	24%	1%	5%
ELECTRICAL	88%	90%	40%	15%	7%
MECHANICAL	96%	94%	22%	3%	6%
METALLURGICAL/MATERIALS	92%	83%	30%	7%	6%
OTHER, N.E.C.	93%	58%	22%	6%	28%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES IN THE NATION. ESTIMATES ARE OF USERS DURING 1982. SAMPLE IS 2446 INSTRUMENT SYSTEMS.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 39B. TYPES OF RESEARCH USERS OF IN-USE ACADEMIC RESEARCH INSTRUMENT SYSTEMS, BY AGRICULTURAL AND BIOLOGICAL SCIENCES SUBFIELD [1]

	PERCENT OF IN-USE SYSTEMS USED BY				
	FACULTY, THIS DEPT./ FACILITY	GRADUATE AND MEDICAL STUDENTS AND POST DOCS., THIS DEPT./ FACILITY	RESEARCHERS FROM OTHER DEPTS. THIS INSTITUTION	RESEARCHERS FROM OTHER UNIVERSITIES	NONACADEMIC RESEARCHERS
AGRICULTURAL AND BIOLOGICAL SCIENCES					
AGRICULTURAL SCIENCES, TOTAL	94%	84%	46%	6%	10%
AGRONOMIC SCIENCES	95%	81%	44%	8%	11%
ANIMAL SCIENCES	93%	89%	54%	1%	9%
NATURAL RESOURCE MGMT	92%	87%	39%	10%	10%
BIOLOGICAL SCIENCES, TOTAL	95%	86%	36%	9%	13%
ANATOMY	95%	80%	33%	6%	10%
BIOCHEMISTRY	94%	87%	40%	9%	12%
BOTANY	97%	88%	35%	13%	17%
FOOD AND NUTRITION	91%	91%	39%	17%	19%
MICROBIOLOGY/IMMUNOLOGY	96%	86%	46%	6%	9%
MOLECULAR/CELLULAR BIOLOGY AND GENETICS	97%	88%	32%	7%	20%
PATHOLOGY	97%	64%	30%	8%	7%
PHARMACOLOGY/TOXICOLOGY	92%	90%	34%	9%	16%
PHYSIOLOGY/BIOPHYSICS	96%	85%	33%	11%	9%
ZOOLOGY/ENTOMOLOGY	97%	87%	31%	8%	10%
BIOLOGY, GENERAL AND N.E.C.	92%	83%	38%	16%	10%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. ESTIMATES ARE OF USERS DURING 1983. SAMPLE IS 2848 INSTRUMENT SYSTEMS.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 40. DEPARTMENT/FACILITY ASSESSMENT OF AVAILABLE INSTRUMENTATION SUPPORT SERVICES, BY FIELD [1]

	PERCENT OF DEPARTMENTS/FACILITIES ASSESSING INSTRUMENTATION SUPPORT SERVICES AS:				
	TOTAL	EXCELLENT	ADEQUATE	INSUFFICIENT	NONEXISTENT
TOTAL, SELECTED FIELDS	100%	11%	39%	36%	13%
FIELD OF RESEARCH					
ENGINEERING	100%	4%	49%	42%	5%
AGRICULTURAL SCIENCES	100%	5%	26%	41%	28%
BIOLOGICAL SCIENCES, TOTAL	100%	17%	34%	31%	19%
GRADUATE SCHOOLS	100%	16%	33%	33%	17%
MEDICAL SCHOOLS	100%	17%	34%	29%	20%
COMPUTER SCIENCE	100%	3%	33%	42%	22%
ENVIRONMENTAL SCIENCES	100%	16%	42%	36%	6%
MATERIALS SCIENCE	100%	50%	42%	9%	-
PHYSICAL SCIENCES	100%	10%	42%	41%	6%
INTERDISCIPLINARY, N.E.C.	100%	7%	75%	18%	-

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. FOR PHASE II FIELDS (AGRICULTRAL, BIOLOGICAL AND ENVIRONMENTAL SCIENCES), ESTIMATES ARE AS OF DECEMBER 1983. FOR ALL OTHER FIELDS, ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 912 DEPARTMENTS AND FACILITIES.

NOTE: SUBCATEGORY PERCENTAGES MAY NOT SUM EXACTLY TO TOTAL BECAUSE OF ROUNDING.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 40A. DEPARTMENT/FACILITY ASSESSMENT OF AVAILABLE INSTRUMENTATION SUPPORT SERVICES, BY PHYSICAL SCIENCES AND ENGINEERING SUBFIELD [1]

	PERCENT OF DEPARTMENTS/FACILITIES ASSESSING INSTRUMENTATION SUPPORT SERVICES AS:				
	TOTAL	EXCELLENT	ADEQUATE	INSUFFICIENT	NONEXISTENT
PHYSICAL SCIENCES AND ENGINEERING					
PHYSICAL SCIENCES, TOTAL	100%	10%	42%	41%	6%
CHEMISTRY	100%	3%	31%	54%	12%
PHYSICS AND ASTRONOMY	100%	17%	52%	30%	1%
ENGINEERING, TOTAL	100%	4%	49%	42%	5%
CHEMICAL	100%	2%	64%	35%	0%
CIVIL	100%	0%	54%	43%	3%
ELECTRICAL	100%	8%	41%	49%	3%
MECHANICAL	100%	6%	63%	32%	0%
METALLURGICAL/MATERIALS	100%	4%	30%	61%	5%
OTHER, N.E.C.	100%	5%	42%	40%	12%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES IN THE NATION. ESTIMATES ARE AS OF DECEMBER 1982. SAMPLE IS 322 DEPARTMENTS AND FACILITIES.

NOTE: SUBCATEGORY PERCENTAGES MAY NOT SUM EXACTLY TO TOTAL BECAUSE OF ROUNDING.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 40B. DEPARTMENT/FACILITY ASSESSMENT OF AVAILABLE INSTRUMENTATION SUPPORT SERVICES, BY AGRICULTURAL AND BIOLOGICAL SCIENCES SUBFIELD [1]

	PERCENT OF DEPARTMENTS/FACILITIES ASSESSING INSTRUMENTATION SUPPORT SERVICES AS:				
	TOTAL	EXCELLENT	ADEQUATE	INSUFFICIENT	NONEXISTENT
AGRICULTURAL AND BIOLOGICAL SCIENCES					
AGRICULTURAL SCIENCES, TOTAL	100%	5%	26%	41%	28%
AGRONOMIC SCIENCES	100%	4%	29%	45%	23%
ANIMAL SCIENCES	100%	3%	21%	45%	31%
NATURAL RESOURCE MGMT	100%	8%	31%	26%	35%
BIOLOGICAL SCIENCES, TOTAL	100%	17%	34%	31%	19%
ANATOMY	100%	22%	46%	22%	10%
BIOCHEMISTRY	100%	16%	30%	37%	17%
BOTANY	100%	6%	54%	18%	22%
FOOD AND NUTRITION	100%	0%	33%	54%	14%
MICROBIOLOGY/IMMUNOLOGY	100%	12%	37%	34%	18%
MOLECULAR/CELLULAR BIOLOGY AND GENETICS	100%	32%	35%	9%	25%
PATHOLOGY	100%	8%	26%	44%	22%
PHARMACOLOGY/TOXICOLOGY	100%	20%	19%	24%	38%
PHYSIOLOGY/BIOPHYSICS	100%	32%	38%	17%	13%
ZOOLOGY/ENTOMOLOGY	100%	12%	31%	40%	18%
BIOLOGY, GENERAL AND N.E.C.	100%	13%	33%	38%	15%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. ESTIMATES ARE AS OF DECEMBER 1983. SAMPLE IS 434 DEPARTMENTS AND FACILITIES.

NOTE: SUBCATEGORY PERCENTAGES MAY NOT SUM EXACTLY TO TOTAL BECAUSE OF ROUNDING.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 41. ANNUAL EXPENDITURES PER DEPARTMENT/FACILITY FOR MAINTENANCE AND REPAIR OF RESEARCH EQUIPMENT, BY TYPE OF EXPENDITURE AND BY FIELD [1]

[DOLLARS IN THOUSANDS]

	MEAN ANNUAL EXPENDITURES PER DEPARTMENT FOR MAINTENANCE AND REPAIR OF RESEARCH EQUIPMENT			
	TOTAL	M/R SERVICE CONTRACTS AND FIELD SERVICE	UNIVERSITY-EMPLOYED M/R PERSONNEL SALARIES	M/R SUPPLIES, EQUIPMENT, AND FACILITIES
TOTAL, SELECTED FIELDS	$35.3	$14.7	$14.8	$6.8
FIELD OF RESEARCH				
ENGINEERING	28.4	7.9	15.1	5.5
AGRICULTURAL SCIENCES	19.6	10.1	5.3	4.3
BIOLOGICAL SCIENCES	26.9	16.7	6.0	4.4
GRADUATE SCHOOLS	23.8	15.3	5.2	3.9
MEDICAL SCHOOLS	29.3	18.0	6.8	4.9
COMPUTER SCIENCE	70.3	37.7	17.7	14.9
ENVIRONMENTAL SCIENCES	39.0	16.6	17.5	5.6
MATERIALS SCIENCE	120.8	28.8	66.6	25.4
PHYSICAL SCIENCES	69.0	15.8	43.2	16.8
INTERDISCIPLINARY, N.E.C.	38.5	18.0	15.2	5.4

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. FOR PHASE II FIELDS (AGRICULTURAL, BIOLOGICAL AND ENVIRONMENTAL SCIENCES), ESTIMATES ARE FOR FY 1983. FOR ALL OTHER FIELDS, ESTIMATES ARE FOR FY 1982. SAMPLE IS 912 DEPARTMENTS AND FACILITIES.

SOURCE: NATIONAL SCIENCE FOUNDATION

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TABLE 41A. ANNUAL EXPENDITURES PER DEPARTMENT/FACILITY FOR MAINTENANCE AND REPAIR OF RESEARCH EQUIPMENT, BY TYPE OF EXPENDITURES AND BY PHYSICAL SCIENCES AND ENGINEERING SUBFIELD [1]

[DOLLARS IN THOUSANDS]

PHYSICAL SCIENCES AND ENGINEERING	MEAN ANNUAL EXPENDITURES PER DEPARTMENT FOR MAINTENANCE AND REPAIR OF RESEARCH EQUIPMENT			
	TOTAL	M/R SERVICE CONTRACTS AND FIELD SERVICE	UNIVERSITY-EMPLOYED M/R PERSONNEL SALARIES	M/R SUPPLIES, EQUIPMENT, AND FACILITIES
PHYSICAL SCIENCES, TOTAL	$69.0	$15.8	$43.2	$16.8
CHEMISTRY	66.3	14.2	36.6	15.6
PHYSICS AND ASTRONOMY	71.3	17.2	49.2	17.9
ENGINEERING, TOTAL	28.4	7.9	15.1	5.5
CHEMICAL	28.9	4.7	17.0	7.1
CIVIL	12.0	3.7	5.8	2.6
ELECTRICAL	32.6	14.1	29.3	9.2
MECHANICAL	33.2	8.7	19.6	4.9
METALLURGICAL/MATERIALS	29.0	5.0	17.0	7.0
OTHER, N.E.C.	25.7	9.8	11.4	4.7

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES IN THE NATION. ESTIMATES ARE FOR FY 1982. SAMPLE IS 322 DEPARTMENTS AND FACILITIES.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 41B. ANNUAL EXPENDITURES PER DEPARTMENT/FACILITY FOR MAINTENANCE AND REPAIR OF RESEARCH EQUIPMENT, BY TYPE OF EXPENDITURE AND BY AGRICULTURAL AND BIOLOGICAL SCIENCES SUBFIELD [1]

[DOLLARS IN THOUSANDS]

	MEAN ANNUAL EXPENDITURES PER DEPARTMENT FOR MAINTENANCE AND REPAIR OF RESEARCH EQUIPMENT			
	TOTAL	M/R SERVICE CONTRACTS AND FIELD SERVICE	UNIVERSITY-EMPLOYED M/R PERSONNEL SALARIES	M/R SUPPLIES, EQUIPMENT, AND FACILITIES
AGRICULTURAL AND BIOLOGICAL SCIENCES				
AGRICULTURAL SCIENCES, TOTAL	$19.6	$10.0	$5.2	$4.2
AGRONOMIC SCIENCES	28.3	15.6	8.5	3.9
ANIMAL SCIENCES	8.3	5.9	.1	2.7
NATURAL RESOURCE MGMT	19.7	5.7	6.8	7.3
BIOLOGICAL SCIENCES, TOTAL	26.9	16.7	6.0	4.4
ANATOMY	30.5	18.5	4.1	7.9
BIOCHEMISTRY	29.1	19.4	5.9	4.0
BOTANY	13.1	11.6	1.5	1.5
FOOD AND NUTRITION	15.6	8.3	3.5	2.6
MICROBIOLOGY/IMMUNOLOGY	16.0	11.8	1.8	2.5
MOLECULAR/CELLULAR BIOLOGY AND GENETICS	34.8	22.1	7.8	4.9
PATHOLOGY	27.0	15.2	4.9	2.5
PHARMACOLOGY/TOXICOLOGY	26.2	21.0	3.4	3.5
PHYSIOLOGY/BIOPHYSICS	33.0	15.5	11.8	5.9
ZOOLOGY/ENTOMOLOGY	18.5	8.5	6.5	6.0
BIOLOGY, GENERAL AND N.E.C.	34.1	20.7	9.0	5.2

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. ESTIMATES ARE FOR FY 1983. SAMPLE IS 454 DEPARTMENTS AND FACILITIES.

SOURCE: NATIONAL SCIENCE FOUNDATION

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TABLE 42. PRINCIPAL MEANS OF SERVICING IN-USE ACADEMIC RESEARCH INSTRUMENTS, BY FIELD AND AGE [1]

	PERCENT OF IN-USE SYSTEMS BY PRINCIPAL MEANS OF SERVICING [2]					
	TOTAL	SERVICE CONTRACT	NONE REQUIRED	FIELD SERVICE	UNIV. M/R PERSONNEL	RESEARCH PERSONNEL
TOTAL, SELECTED FIELDS	100%	24%	18%	24%	17%	15%
FIELD OF RESEARCH						
ENGINEERING	100%	12%	20%	21%	26%	21%
AGRICULTURAL SCIENCES	100%	24%	23%	31%	12%	11%
BIOLOGICAL SCIENCES, TOTAL	100%	39%	17%	26%	10%	9%
GRADUATE SCHOOLS	100%	38%	17%	26%	12%	8%
MEDICAL SCHOOLS	100%	40%	17%	26%	8%	9%
COMPUTER SCIENCE	100%	33%	8%	25%	13%	21%
ENVIRONMENTAL SCIENCES	100%	10%	19%	20%	49%	10%
MATERIALS SCIENCE	100%	11%	13%	13%	49%	20%
PHYSICAL SCIENCES	100%	8%	10%	20%	49%	23%
[illegible]	100%	20%	21%	21%	17%	19%
SYSTEM AGE (BASE YEAR OF PURCHASE) [3]						
1-5 YEARS	100%	24%	22%	26%	19%	13%
6-10 YEARS	100%	24%	12%	29%	19%	16%
OVER 10 YEARS	100%	19%	14%	28%	28%	19%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 90 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. FOR PHASE II FIELDS (AGRICULTURAL, BIOLOGICAL AND ENVIRONMENTAL SCIENCES), ESTIMATES ARE FOR FY 1983. FOR ALL OTHER FIELDS, ESTIMATES ARE FOR FY 1982. SAMPLE IS 703 INSTRUMENT SYSTEMS.

[2] IF MORE THAN ONE FORM OF SERVICING WAS USED IN THE SURVEY YEAR, THE INSTRUMENT SYSTEM WAS ASSIGNED TO THE FIRST-LISTED CATEGORY THAT APPLIES.

[3] FOR PHASE II FIELDS, AGE INTERVALS ARE 1-5 YEARS (1979-83); 6-10 YEARS (1974-78); OVER 10 YEARS (1973 OR BEFORE). FOR PHASE I FIELDS, INTERVALS ARE 1-5 YEARS (1978-82); 6-10 YEARS (1973-77); OVER 10 YEARS (1972 OR BEFORE).

NOTE: SUBCATEGORY PERCENTAGES MAY NOT SUM EXACTLY TO TOTAL BECAUSE OF ROUNDING.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 42A. PRINCIPAL MEANS OF SERVICING IN-USE ACADEMIC RESEARCH INSTRUMENTS, BY PHYSICAL SCIENCES AND ENGINEERING SUBFIELD [1]

	PERCENT OF IN-USE SYSTEMS BY PRINCIPAL MEANS OF SERVICING [2]					
	TOTAL	SERVICE CONTRACT	NONE REQUIRED	FIELD SERVICE	UNIV. M/R PERSONNEL	RESEARCH PERSONNEL
PHYSICAL SCIENCES AND ENGINEERING						
PHYSICAL SCIENCES, TOTAL	100%	8%	18%	24%	28%	23%
CHEMISTRY	100%	9%	15%	29%	30%	18%
PHYSICS AND ASTRONOMY	100%	7%	21%	19%	25%	28%
ENGINEERING, TOTAL	100%	12%	20%	21%	26%	21%
CHEMICAL	100%	9%	20%	30%	14%	27%
CIVIL	100%	21%	23%	29%	25%	2%
ELECTRICAL	100%	14%	13%	19%	26%	28%
MECHANICAL	100%	11%	35%	21%	24%	9%
METALLURGICAL/MATERIALS	100%	11%	23%	25%	22%	20%
OTHER, N.E.C.	100%	11%	13%	14%	25%	37%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 1ST LARGEST R & D UNIVERSITIES IN THE NATION. ESTIMATES ARE FOR 1982; SAMPLE IS 2444 INSTRUMENT SYSTEMS.

[2] IF MORE THAN ONE FORM OF SERVICING WAS USED IN THE SURVEY YEAR, THE INSTRUMENT SYSTEM WAS ASSIGNED TO THE FIRST-LISTED CATEGORY THAT APPLIED.

NOTE: SUBCATEGORY PERCENTAGES MAY NOT SUM EXACTLY TO TOTAL BECAUSE OF ROUNDING.

SOURCE: NATIONAL SCIENCE FOUNDATION

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TABLE 429. PRINCIPAL MEANS OF SERVING IN-USE ACADEMIC RESEARCH INSTRUMENTS, BY AGRICULTURAL AND BIOLOGICAL SCIENCES SUBFIELD [1]

	PERCENT OF IN-USE SYSTEMS BY PRINCIPAL MEANS OF SERVICING [2]					
	TOTAL	SERVICE CONTRACT	NONE REQUIRED	FIELD SERVICE	UNIV. M/R PERSONNEL	RESEARCH PERSONNEL
AGRICULTURAL AND BIOLOGICAL SCIENCES						
AGRICULTURAL SCIENCES, TOTAL	100%	24%	23%	31%	12%	11%
AGRONOMIC SCIENCES	100%	20%	23%	33%	12%	12%
ANIMAL SCIENCES	100%	34%	23%	28%	8%	7%
NATURAL RESOURCE MGMT	100%	22%	23%	23%	24%	8%
BIOLOGICAL SCIENCES, TOTAL	100%	39%	17%	24%	10%	9%
ANATOMY	100%	35%	33%	25%	1%	5%
BIOCHEMISTRY	100%	41%	15%	24%	10%	8%
BOTANY	100%	33%	14%	30%	17%	7%
FOOD AND NUTRITION	100%	10%	04%	27%	26%	17%
MICROBIOLOGY/IMMUNOLOGY	100%	08%	17%	00%	8%	6%
MOLECULAR/CELLULAR BIOLOGY AND GENETICS	100%	01%	19%	00%	0%	0%
PATHOLOGY	100%	00%	11%	01%	7%	0%
PHARMACOLOGY/TOXICOLOGY	100%	00%	10%	00%	0%	10%
PHYSIOLOGY/BIOPHYSICS	100%	01%	00%	00%	10%	10%
ZOOLOGY/ENTOMOLOGY	100%	10%	01%	01%	0%	0%
BIOLOGY, GENERAL AND O.S.C.	100%	05%	01%	00%	10%	0%

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 197 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. ESTIMATES ARE FOR FY 1983. SAMPLE IS 8048 INSTRUMENTS SYSTEMS.

[2] IF MORE THAN ONE FORM OF SERVICING WAS USED IN THE SURVEY YEAR, THE INSTRUMENT SYSTEM WAS ASSIGNED TO THE FIRST-LISTED CATEGORY THAT APPLIED.

NOTE: SUBCATEGORY PERCENTAGES MAY NOT SUM EXACTLY TO TOTAL BECAUSE OF ROUNDING.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 43. MEAN ANNUAL EXPENDITURES PER SYSTEM FOR MAINTENANCE AND REPAIR OF IN-USE ACADEMIC RESEARCH INSTRUMENTS SYSTEMS, BY PRINCIPAL MEANS OF SERVICING AND BY FIELD (1)

	MEAN EXPENDITURES PER SYSTEM FOR M/R, BY PRINCIPAL MEANS OF SERVICING (2)					
	TOTAL	SERVICE CONTRACT	NONE REQUIRED	FIELD SERVICE	UNIV. M/R PERSONNEL	RESEARCH PERSONNEL
TOTAL, SELECTED FIELDS	$1500	$3200	$0	$1400	$1300	$800
FIELD OF RESEARCH						
ENGINEERING	1200	4900	0	1400	1100	600
AGRICULTURAL SCIENCES	900	1700	0	1000	700	500
BIOLOGICAL SCIENCES, TOTAL	1100	8300	0	700	600	500
GRADUATE SCHOOLS	1000	1900	0	700	600	400
MEDICAL SCHOOLS	1200	2400	0	700	600	500
COMPUTER SCIENCE	3700	6200	0	900	2000	0
ENVIRONMENTAL SCIENCES	2100	7100	0	2500	1700	1100
MATERIALS SCIENCE	2500	4500	0	1300	4900	1300
PHYSICAL SCIENCES	1800	6400	0	2600	1700	1100
INTERDISCIPLINARY, N.E.C.	1900	5300	0	1700	1100	1400

(1) ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 50 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. FOR PHASE II FIELDS (AGRICULTURAL, BIOLOGICAL AND ENVIRONMENTAL SCIENCES), ESTIMATES ARE FOR THE FY 1983. FOR ALL OTHER FIELDS, ESTIMATES ARE FOR FY 1982. SAMPLE IS 7013 INSTRUMENT SYSTEMS.

(2) IF MORE THAN ONE TYPE OF SERVICING WAS USED IN THE SURVEY YEAR, THE INSTRUMENT SYSTEM WAS ASSIGNED TO THE HIGHEST-CITED CATEGORY THAT APPLIED.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 43a. MEAN ANNUAL EXPENDITURES PER SYSTEM FOR MAINTENANCE AND REPAIR OF IN-USE ACADEMIC RESEARCH INSTRUMENTS SYSTEMS, BY PRINCIPAL MEANS OF SERVICING AND BY PHYSICAL SCIENCES AND ENGINEERING SUBFIELD [1]

	MEAN EXPENDITURES PER SYSTEM FOR M/R, BY PRINCIPAL MEANS OF SERVICING [2]					
	TOTAL	SERVICE CONTRACT	HOME REQUIRED	FIELD SERVICE	UNIV. M/R PERSONNEL	RESEARCH PERSONNEL
PHYSICAL SCIENCES AND ENGINEERING						
PHYSICAL SCIENCES, TOTAL	$1800	$6400	$0	$2600	$1700	$1100
CHEMISTRY	1700	4900	0	2300	1400	900
PHYSICS AND ASTRONOMY	2100	8700	0	3000	2200	1300
ENGINEERING, TOTAL	1200	4900	0	1400	1100	600
CHEMICAL	900	3000	0	900	800	900
CIVIL	1100	2500	0	700	1400	100
ELECTRICAL	1500	4900	0	1600	1100	700
MECHANICAL	1400	8400	0	700	1200	1500
METALLURGICAL/MATERIALS	1300	2400	0	2400	900	500
OTHER, N.E.C.	1100	5300	0	1400	1000	100

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES IN THE NATION. ESTIMATES ARE FOR 1982. SAMPLE IS 2446 INSTRUMENT SYSTEMS.

[2] IF MORE THAN ONE FORM OF SERVICING WAS USED IN THE SURVEY YEAR, THE INSTRUMENT SYSTEM WAS ASSIGNED TO THE FIRST-LISTED CATEGORY THAT APPLIED.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 420. MEAN ANNUAL EXPENDITURES PER SYSTEM FOR MAINTENANCE AND REPAIR OF IN-USE ACADEMIC RESEARCH INSTRUMENTS SYSTEMS, BY PRINCIPAL MEANS OF SERVICING AND BY AGRICULTURAL AND BIOLOGICAL SCIENCES SUBFIELD [1]

	MEAN EXPENDITURES PER SYSTEM FOR M/R, BY PRINCIPAL MEANS OF SERVICING [2]					
	TOTAL	SERVICE CONTRACT	NONE REQUIRED	FIELD SERVICE	UNIV. M/R PERSONNEL	RESEARCH PERSONNEL
AGRICULTURAL AND BIOLOGICAL SCIENCES						
AGRICULTURAL SCIENCES TOTAL	$900	$1700	$0	$1000	$700	$300
AGRONOMIC SCIENCES	800	1600	0	1100	700	400
ANIMAL SCIENCES	900	1900	0	800	900	200
NATURAL RESOURCE MGMT	900	1700	0	1500	600	200
BIOLOGICAL SCIENCES- TOTAL	1100	2300	0	700	600	500
ANATOMY	1600	4200	0	500	4200	0
BIOCHEMISTRY	1000	1600	0	700	600	700
BOTANY	1000	2200	0	700	300	100
FOOD AND NUTRITION	600	2500	0	400	500	300
MICROBIOLOGY/IMMUNOLOGY	1200	1900	0	1100	300	300
MOLECULAR/CELLULAR BIOLOGY AND GENETICS	1200	2100	0	400	800	0
PATHOLOGY	1600	3100	0	500	200	300
PHARMACOLOGY/TOXICOLOGY	1000	1800	0	900	600	700
PHYSIOLOGY/BIOPHYSICS	1000	2800	0	600	600	200
ZOOLOGY/ENTOMOLOGY	700	3000	0	400	200	400
BIOLOGY, GENERAL AND O.E.C.	1700	3400	0	1300	1000	1200

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. ESTIMATES ARE FOR FY 1983. SAMPLE IS 2048 INSTRUMENTS SYSTEMS.

[2] IF MORE THAN ONE FORM OF SERVICING WAS USED IN THE SURVEY YEAR, THE INSTRUMENT SYSTEM WAS ASSIGNED TO THE FIRST-LISTED CATEGORY THAT APPLIED.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 66. MEAN ANNUAL EXPENDITURES PER SYSTEM FOR MAINTENANCE AND REPAIR OF IN-USE ACADEMIC RESEARCH INSTRUMENTS SYSTEMS, BY PRINCIPAL MEANS OF SERVICING AND BY PURCHASE PRICE AND AGE [1]

	MEAN EXPENDITURES PER SYSTEM FOR M/R, BY PRINCIPAL MEANS OF SERVICING [2]					
	TOTAL	SERVICE CONTRACT	NONE REQUIRED	FIELD SERVICE	UNIV. M/R PERSONNEL	RESEARCH PERSONNEL
TOTAL, SELECTED FIELDS	$1500	$3200	$0	$1400	$1200	$800
SYSTEM PURCHASE PRICE						
$10,000 - $24,999	600	1400	0	700	500	300
$25,000 - $74,999	1500	3000	0	1300	1400	900
$75,000 - $1,000,000	7100	11200	0	5800	3100	4500
SYSTEM AGE (FROM YEAR OF PURCHASE) [3]						
1-5 YEARS	1500	3600	0	1400	1100	900
6-10 YEARS	1500	2600	0	1400	1600	800
OVER 10 YEARS	1400	2900	0	1500	1400	700

[1] ALL STATISTICS ARE NATIONAL ESTIMATES ENCOMPASSING THE 157 LARGEST R & D UNIVERSITIES AND THE 92 LARGEST R & D MEDICAL SCHOOLS IN THE NATION. FOR PHASE II FIELDS (AGRICULTURAL, BIOLOGICAL AND ENVIRONMENTAL SCIENCES), ESTIMATES ARE FOR THE FY 1983. FOR ALL OTHER FIELDS, ESTIMATES ARE FOR FY 1982. SAMPLE IS 7013 INSTRUMENT SYSTEMS.

[2] IF MORE THAN ONE FORM OF SERVICING WAS USED IN THE SURVEY YEAR, THE INSTRUMENT SYSTEM WAS ASSIGNED TO THE FIRST-LISTED CATEGORY THAT APPLIED.

[3] FOR PHASE II FIELDS, AGE INTERVALS ARE 1-5 YEARS (1979-83); 6-10 YEARS (1974-78); OVER 10 YEARS (1973 OR BEFORE). FOR PHASE I FIELDS INTERVALS ARE 1-5 YEARS (1978-82); 6-10 YEARS (1973-77); OVER 10 YEARS (1972 OR BEFORE).

SOURCE: NATIONAL SCIENCE FOUNDATION

APPENDIX C

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APPENDIX C

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APPENDIX D

Interagency Working Group on University Research Instrumentation

APPENDIX D

Interagency Working Group on
University Research Instrumentation

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APPENDIX E

Department/Facility Questionnaire
(Phase II)

Form
Number:

OMB No. 3145-0067
Expiration Date 9/30/85

NATIONAL SURVEY OF ACADEMIC RESEARCH INSTRUMENTS AND INSTRUMENTATION NEEDS

NATIONAL SCIENCE FOUNDATION and NATIONAL INSTITUTES OF HEALTH

DEPARTMENT/FACILITY QUESTIONNAIRE

THIS REPORT IS AUTHORIZED BY LAW (P.L. 96-44). WHILE YOU ARE NOT REQUIRED TO RESPOND, YOUR COOPERATION IS NEEDED TO MAKE THE RESULTS OF THIS SURVEY COMPREHENSIVE, ACCURATE, AND TIMELY. INFORMATION GATHERED IN THIS SURVEY WILL BE USED ONLY FOR DEVELOPING STATISTICAL SUMMARIES. INDIVIDUAL PERSONS, INSTITUTIONS, AND DEPARTMENTS WILL NOT BE IDENTIFIED IN PUBLISHED SUMMARIES OF THE DATA.

BACKGROUND AND INSTRUCTIONS

In recent years, widespread concern has developed about whether academic research scientists and engineers have sufficient access to the kinds of equipment needed to permit continuing research at the frontier of scientific knowledge. To assist the National Science Foundation, the National Institutes of Health, and other Federal agencies in setting appropriate equipment funding levels and priorities, this congressionally mandated survey is intended to document, for the first time: (a) the amount, cost, and condition of the scientific research equipment currently available in the nation's principal research universities, and (b) the nature and extent of the need for upgraded or expanded equipment in the major fields of science and engineering.

The survey is being conducted in two phases. The current phase (Phase II) deals with research equipment in the biological, environmental, and agricultural sciences. Last year, in Phase I, the emphasis was on the physical sciences and engineering/computer science.

This Department (or nondepartmental research facility) Questionnaire seeks a broad overview of equipment-related expenditures and needs in this department (or facility). Items 1-10 (Parts A and B) are factual in nature and may be delegated to any person or persons who can provide the requested data. In these sections, informed estimates are acceptable whenever precise information is not available from annual reports or other data sources. Items 11-16 (Part C) call for judgmental assessments about equipment-related research needs and priorities of the department (or facility) as a whole and should be answered by the department chairperson (or facility director) or by a designee who is in a position to make such judgments. We urge that particular attention be given to Item 16, which asks for this department's (or facility's) recommendations about needed changes in equipment funding policies and procedures.

This form should be returned to your institution's study coordinator. Your cooperation in returning the survey form promptly is very important. Please direct any questions about this form either to your study coordinator or to Ms. Dianne Walsh at Westat, Inc., the NSF/NIH contractor for this study (301-251-1500).

PART A. DESCRIPTIVE INFORMATION

1. Institution name: _____

2. Department (or nondepartmental research facility) name:

_____

3. This is a: (CHECK ONE)

|__| 1. Nondepartmental research facility (SKIP TO ITEM 6)

|__| 2. Medical school clinical department (SKIP TO ITEM 5)

|__| 3. Other university or medical school department (CONTINUE WITH ITEM 4)

4. Number of doctoral degrees awarded in 1982-83 academic year to students in this department:

_____

5. Number of faculty and equivalent nonfaculty researchers of this department who participate in ongoing research projects (do not include graduate or medical students, postdoctorates, clinical fellows, or technicians):

_____ Total number of persons (full-time and part-time)

_____ FTE* number of persons

*In computing number of FTEs (full-time equivalents), persons employed in this department on less than a full-time basis should be counted to reflect their decimal fraction of full-time equivalency. Example: if a department employs 25 pertinent faculty members, 20 full-time and 5 with half-time appointments, the FTE number is 20 + (5 x .5) = 22.5.

PART B. RESEARCH-RELATED FUNDING AND EXPENDITURES

6. Department (or facility) FY 1983 and anticipated FY 1984 expenditures for scientific research equipment. [SCIENTIFIC RESEARCH EQUIPMENT IS ANY ITEM (OR INTERRELATED COLLECTION OF ITEMS COMPRISING A SYSTEM) OF NONEXPENDABLE TANGIBLE PROPERTY OR SOFTWARE HAVING A USEFUL LIFE OF MORE THAN TWO YEARS AND AN ACQUISITION COST OF $500 OR MORE WHICH IS USED WHOLLY OR IN PART FOR RESEARCH. INCLUDE ALL SCIENTIFIC RESEARCH EQUIPMENT ACQUIRED FROM ALL SOURCES -- FEDERAL, STATE, INSTITUTIONAL, INDUSTRIAL, ETC.]

$_____ 1983 expenditures for scientific research equipment

$_____ Anticipated FY 1984 expenditures for scientific research equipment

7. Please provide an approximate breakdown by source of funds for this department's (or facility's) FY 1983 expenditures and estimated FY 1984 expenditures for scientific research equipment. [Data should be each column should add to 100 percent. Estimates are acceptable.]

Source of funds	Percent of expenditures for scientific research equipment	
	FY 1983	FY 1984 (anticipated)
a. Federal Government	_____ %	_____ %
b. Internal institution funds	_____ %	_____ %
c. State equipment or capital development appropriations	_____ %	_____ %
d. Private nonprofit foundations/ organizations	_____ %	_____ %
e. Business or industry	_____ %	_____ %
f. Other (SPECIFY) _____		
_____	_____ %	_____ %
TOTAL, ALL FUNDING SOURCES	100 %	100 %

8. FY 1983 expenditures for purchase of research-related computer services at:

$_____ Institution computing facilities

$_____ Other computing facilities

9. FY 1983 expenditures for maintenance and repair of all scientific research equipment in this department (or facility):

$_____ Service contracts or field service for maintenance and repair of individual instruments

$_____ Salaries of institution maintenance/repair personnel (prorate if personnel do not work full-time in this department/facility or on servicing of research equipment)

$_____ Other direct costs of supplies, equipment and facilities for servicing of research instruments in this department/facility

$_____ Total

10. Are the instrumentation support services (e.g., machine shop, electronics shops) at this department or facility: (CHECK ONE)

|__| 1. Excellent

|__| 2. Adequate

|__| 3. Insufficient

|__| 4. Nonexistent

PART C. ADEQUACY OF AND NEED FOR SCIENTIFIC RESEARCH EQUIPMENT

11. In terms of its capability to enable investigators to pursue their major research interests, is the research equipment in this department (or facility) generally: (CHECK ONE IN EACH COLUMN)

	Type of investigator	
	Tenured faculty (and equivalent P.I.'s)	Untenured faculty (and equivalent P.I.'s)
1. Excellent	1. |__|	1. |__|
2. Adequate	2. |__|	2. |__|
3. Insufficient	3. |__|	3. |__|

12. If greater Federal funding of research equipment were possible, in which single area would increased investment be most beneficial to investigators in this department/facility? (CHECK ONE)

\|__\| 1. Large scale regional and national instrumentation facilities

\|__\| 2. Major shared access instrument systems ($50,000-$1,000,000) not presently available to department/facility members

\|__\| 3. Upgrading/expansion of equipment in $10,000-$50,000 range

\|__\| 4. General enhancement of equipment and supplies in labs of individual P.I.'s (items generally below $10,000)

\|__\| 5. Other (SPECIFY) _____

_____

13. In the $10,000-$1,000,000 cost range, what three items of research equipment (if any) are most needed at this time in this department/facility?

Item description	Approximate cost
_____	_____
_____	_____
_____	_____

14. Are there any important subject areas (e.g., pharmacokinetics, genetic engineering, integrated pest management) in which investigators in this department/facility are unable to perform critical experiments in their areas of research interest due to lack of needed equipment?

\|__\| 1. Yes ——► 12a. In what subject areas is improved instrumentation most needed? (SPECIFY UP TO THREE AREAS)

_____

_____

\|__\| 2. No _____

15. Assuming future Federal research support to your department/facility remains at its present level, how - if at all - would your department (or facility) redistribute the total? FOR EACH AREA, PLEASE INDICATE WHETHER FUNDING SHOULD BE PROPORTIONATELY INCREASED, DECREASED, OR MAINTAINED AT ABOUT THE PRESENT LEVEL. (NOTE: PROPORTIONATE INCREASES IN ONE OR MORE AREAS MUST BE ACCOMPANIED BY CORRESPONDING DECREASES IN OTHER AREAS. IF THE CURRENT BALANCE SHOULD BE MAINTAINED, CHECK "NO CHANGE" COLUMN FOR ALL AREAS.)

Area of Federal support	Recommended redistribution of research funds		
	1. Increase	2. Decrease	3. No change
a. Faculty salaries	|__|	|__|	|__|
b. Postdoctorate salaries	|__|	|__|	|__|
c. Graduate student support	|__|	|__|	|__|
d. Non-professional salaries	|__|	|__|	|__|
e. Equipping of startup labs	|__|	|__|	|__|
f. Equipment purchases (other than e, above)	|__|	|__|	|__|
g. Equipment maintenance	|__|	|__|	|__|
h. Other (SPECIFY) _____			
_____	|__|	|__|	|__|

16. How could current Federal equipment funding policies and/or procedures be modified to better meet the research needs of researchers in this department/facility?

_____

_____

_____

_____

17. Please note in the space below: (a) any additional information needed to describe the research equipment and equipment-related needs in this department/facility, or (b) any suggestions to improve this survey questionnaire.

_____

_____

_____

_____

_____

18. Person who prepared this submission:

_____ _____

NAME AND TITLE AREA CODE - EXCH - NO. - EXT.

19. How many person-hours were required to complete this form? _____ _____

HOURS MINUTES

APPENDIX F

Instrument Data Sheet
(Phase II)

Form Number

OMB No. 3145-0067
Expiration Date 9/30/85

NATIONAL SURVEY OF ACADEMIC RESEARCH INSTRUMENTS AND INSTRUMENTATION NEEDS

NATIONAL SCIENCE FOUNDATION
Washington, D.C. 20550

INSTRUMENT DATA SHEET

This data sheet is part of a major national assessment of the condition of university research instrumentation. The data sheet concerns a particular instrument selected (from university central records) as part of a small national sample of research instruments in your field.

The item described below (in ID BOX) is believed to be an active research instrument located in this department or research facility as of December 31, 1982. Please note in the comments section (Question 17) if this assumption is incorrect, however, please complete as much of this form as possible.

We ask that the requested factual information (items 1-8) and functional assessment data (items 9-16) be obtained from the person or persons who are most knowledgeable about the history and current status of this instrument.

All cost data should be rounded to the nearest thousand dollars. For example, a purchase cost of $25,342 should be reported as $25,000. Where exact cost (or other) data are not available, estimates are acceptable. Your estimates will be better than ours.

This study is authorized by law (P.L. 96-44). While you are not required to respond, your cooperation is needed to make the results of this survey comprehensive, accurate, and timely. Information gathered in this survey will be used only for developing statistical summaries. Individual persons, institutions, and departments will not be identified in published summaries of the data.

This form should be returned by May 30, 1983. Your cooperation in returning the survey form promptly is very important. Please direct any questions about this form either to your university study coordinator or to Ms. Dianne Walsh at Westat, Inc., the NSF contractor for this study (301-251-1500).

DEFINITION OF KEY TERMS

INSTRUMENT PURCHASE COST (initial value)

The original cost of the instrument (or its components, if built locally) at time of purchase from the manufacturer. Do not include cost of separately purchased accessories; do not subtract any discount (e.g., for trade-in) which may have been received. Please estimate if original records are not available.

ACQUISITION COST

The actual cost of this instrument when acquired at this university. If purchased new by this university, acquisition cost = purchase cost, less discount from manufacturer, if applicable. If built at this university, acquisition cost = cost of parts + estimated cost of labor. If purchased used, acquisition cost = price paid to seller. If donated or loaned (e.g., by industry) or obtained at no cost from government surplus, acquisition cost = $0.

REPLACEMENT COST

The estimated cost to purchase this instrument (or its components, if built locally) or one of roughly equivalent function and capability, at today's prices.

DEDICATED ACCESSORIES

Separately acquired "add-ons" to or components of the instrumentation system of which the instrument described below is the principal element. This includes accessories that are presently (as of December 31, 1982) dedicated solely for use with the reference instrument but are not included in its purchase cost (in item G, below). Examples: specimen preparation and photographic accessories for a particular electron microscope, oscilloscope, microprocessor, HPLC, or data system accessories for a particular spectrometer, key entry, disc drive, printer or plotter accessories for a particular microcomputer.

SYSTEM PURCHASE COST

The instrument purchase cost plus the aggregate purchase cost of its dedicated accessories, if any.

YEAR OF PURCHASE

The calendar year when this instrument (or its principal component) was originally purchased from the manufacturer.

ID BOX - INSTRUMENT IDENTIFYING DATA

A. University _____

B. Department or Facility _____

C. Instrument Description _____

_____

D. Central Records ID # _____

E. Assigned to: _____

F. **Year of Purchase:** 19_____ G. **Instrument Purchase Cost:** 218

SEE PAGE 1 FOR DEFINITION OF ALL BOLDFACE TERMS

1. Please review the identifying data (from your university's central records) in the page 1 ID BOX and make any needed corrections or additions, with special attention to items F (**YEAR OF PURCHASE**) and G (**INSTRUMENT PURCHASE COST**).

2. Where was this instrument located during 1982 when in use? (CHECK ONE)

   |__| 1 Not used for teaching or for research in 1982 (SKIP TO ITEM 17)

   |__| 2 Lab used almost exclusively for undergraduate instruction (SKIP TO ITEM 17)

   |__| 3 National, regional, or interuniversity instrumentation lab (CONTINUE TO ITEM 3)

   |__| 4 Nondepartmental research facility (CONTINUE TO ITEM 3)

   |__| 5 Department-managed common lab or instrumentation facility (CONTINUE TO ITEM 3)

   |__| 6 Within-department lab of principal investigator (CONTINUE TO ITEM 3)

   |__| 7 Other (SPECIFY) _____

3. Does this instrument have any **DEDICATED ACCESSORIES** not included in the **INSTRUMENT PURCHASE COST** (from ID BOX, item G)?

   |__| 1 Yes ⟶ 3a. Please describe, and estimate purchase cost for this instrument's separately purchased **DEDICATED ACCESSORIES**.

   |__| 2 No

Description of major accessories	Purchase cost
_____	$_____
_____	$_____
_____	$_____
_____	$_____
Estimated aggregate purchase cost of all **DEDICATED ACCESSORIES** not included in ID BOX item G (those described plus all others)	$_____
SYSTEM PURCHASE COST for instrument plus all **DEDICATED ACCESSORIES**	$_____

4. Year instrument acquired at this university:

   19__

5. **ACQUISITION COST** for this instrument and its accessories:

   $_____ Instrument acquisition cost

   $_____ Accessory acquisition cost

   $_____ Total

6. Estimated **REPLACEMENT COST** for this instrument and its accessories:

   $_____ Instrument replacement cost

   $_____ Accessory replacement cost

   $_____ Total

7. How was this instrument acquired at this university? (CHECK ONE)

|__| 1 Purchased new

|__| 2 Purchased used

|__| 3 Locally built (at or for this university)

|__| 4 Transferred from another university, e.g., by incoming faculty member (SKIP TO ITEM 9)

|__| 5 Government surplus (SKIP TO ITEM 9)

|__| 6 Donated new (SKIP TO ITEM 9)

|__| 7 Donated used (SKIP TO ITEM 9)

|__| 8 Other (SPECIFY) _____

_____

8. Source(s) of funds for acquisition of this instrument (and accessories) at this university. (SPECIFY APPROXIMATE PERCENTAGE CONTRIBUTION TO TOTAL **ACQUISITION COST** FOR EACH APPLICABLE SOURCE.)

Funding contribution (percent)	Funding source
	Federal sources:
_____	NSF (National Science Foundation)
_____	NIH (National Institutes of Health)
_____	DOD (Department of Defense)
_____	DOE (Department of Energy)
_____	Other Federal sources (SPECIFY): _____
	Non-Federal sources:
_____	University or department funds
_____	State grant or appropriation
_____	Private nonprofit foundation
_____	Business or industry
_____	Other (SPECIFY) _____
100%	Total

9. How much was spent for maintenance and repair (not for operation) of this instrument and its accessories in 1982?

$_____

10. Means of servicing (maintenance/repair) this instrument during 1982: (CHECK ALL THAT APPLY)

|__| 1 None required

|__| 2 Service contract

|__| 3 Field service, as needed

|__| 4 University-employed maintenance/repair staff

|__| 5 Research personnel (faculty, post-docs, graduate students)

|__| 6 Other (SPECIFY) _____

11. Instrument's general working condition during 1982: (CHECK ONE)

|__| 1 Excellent

|__| 2 Average

|__| 3 Poor (e.g., unreliable, frequent breakdowns, difficult to maintain or service)

|__| 4 Inoperable entire year

12. Research function of this instrument during 1982: (CHECK ONE)

|__| 1 Most advanced instrument of its kind that is accessible to those who use it in their research

|__| 2 Used for research; more advanced instruments are available to users when needed

|__| 3 Not used for research during 1982

13. Technical capabilities of this instrument (i.e., the base instrument, excluding accessories) -- precision, resolution, speed, volume, etc. (CHECK ONE)

|__| 1 State-of-the-art (most highly developed and technically sophisticated instrument available)

|__| 2 Adequate to meet research needs

|__| 3 Inadequate for research (PLEASE EXPLAIN):

_____

_____

_____

14. Technical capabilities of instrument's current accessories (precision, resolution, speed, volume, etc.): (CHECK ONE)

|_| 1 NA - Instrument does not have, and does not need, accessories

|_| 2 State-of-the-art (most highly developed and scientifically sophisticated available)

|_| 3 Adequate to meet researcher needs

|_| 4 Inadequate for research (PLEASE EXPLAIN)

_____

_____

_____

15. In 1982, was this a general purpose instrument within an area of research or was it dedicated for a particular experiment or series of experiments? (CHECK ONE)

|_| 1 General purpose (SKIP TO ITEM 16)

|_| 2 Dedicated ↓

15a. Did this involve any special calibration, programming or other modification which rendered the instrument unsuitable for general purpose use? (CHECK ONE)

|_| 1 Yes

|_| 2 No

16. Approximate number of research investigators who used this instrument (or for whom it was used) for research purposes during 1982: (ESTIMATE APPROXIMATE NUMBER IN EACH APPLICABLE CATEGORY)

_____ 1 Faculty and equivalent nonfaculty researchers, this department/facility

_____ 2 Graduate and postdoctoral students, this department/facility

_____ 3 Faculty and equivalent nonfaculty researchers, other departments, this university

_____ 4 Graduate and postdoctoral students, other departments, this university

_____ 5 Researchers from other universities

_____ 6 Nonacademic researchers

_____ 7 Other (SPECIFY) _____

16a. Instrument's principal area of scientific/engineering research use in 1982 (e.g., physics, astronomy, chemistry, computer science, electrical engineering):

_____

17. Please note in space below: (a) Any additional information needed to clarify the nature, function and quality of this instrument, or (b) any suggestions to improve this questionnaire or its instructions.

18. Person who prepared this submission:

_____ NAME AND TITLE

_____ AREA CODE - EXCH - NO - EXT

19. How many person-hours were required to complete this form?

_____ HOURS _____ MINUTES

APPENDIX G

Sampling Errors

SAMPLING ERRORS

STANDARD ERRORS OF THE STATISTICS

The findings presented in this report are estimates based on stratified random samples of university departments and of equipment within departments. Consequently, these estimates are subject to sampling variability. If the questionnaires had been sent to different samples, the responses would not have been identical; some estimates would have been higher, while others would have been lower. The estimated standard error of a statistic (a measure of the variation due to sampling) can be used to examine the precision obtained in a particular sample. If all possible samples were surveyed under similar conditions, intervals of 1.965 standard errors below to 1.965 standard errors above a particular statistic would include the average result of these samples in approximately 95 percent of the cases. For example, for the estimated total purchase price of all extant academic research instrument systems in engineering (see Table G-1), the 95 percent confidence interval is \$334 million $\pm$ 1.965 times a standard error of \$42 million. If the above procedure were followed for every possible sample, about 95 percent of the intervals would include the average number from all possible samples.

Table G-1 presents standard errors for various statistics selected to represent all combinations of three important parameters: (a) the survey, whether the instrument survey or the department/facility survey; (b) the type of estimate, whether a total, such as number of systems or aggregate cost, or a ratio, such as a mean or a percentage; and (c) the sample size, as illustrated by fields and subfields of varying size ranging from the all fields total (8,704 systems) down to computer science with only 208 systems.

The balanced half-sample replication technique developed by McCarthy was used to compute variance estimates.[1] It requires that the file be divided into strata of two sets of selected units each, and that within each stratum one set be assigned to group 1 and the other to group 2. Internal to the computer program is an orthogonal matrix which designates (separately for each stratum) whether it is the group 1 unit or the group 2 unit that is included in the half sample for a particular replicate. To prepare the data file for variance estimation, sample items were sorted in their order of selection and were grouped into pairs to define strata. Identical statistics were prepared for each replicate using the same weighting procedure for each replicate that was used in the survey itself. The variation of the estimates among the replicates provides a measure of the survey sampling errors for the statistics.

---

[1]McCarthy, Philip (1966) "Replication, an Approach to the Analysis of Data from Complex Surveys" Public Health Service Publication No. 1000, Series 2, No. 14.

McCarthy, Philip J. (1969) "Pseudoreplication, Further Evaluation and Application of the Balanced Half-Sample Technique" Public Health Service Publication No. 1000, Series 2, No. 31.

Table G-1. Standard errors of selected estimates

Survey and Statistic	Total, all fields		Engineering, Total		Biochemistry		Computer Science	
	Estimate	Standard Error	Estimate	Standard Error	Estimate	Standard Error	Estimate	Standard Error
Survey of existing research instrument systems	(n = 8704)		(n = 1652)		(n = 711)		(n = 208)	
A. Estimates of Totals								
1. Total number of systems in national stock (Table 7)	46,738	-	9,425	483	4,078	282	1,115	66
2. Number of systems with purchase price $10,000-$24,999 (Table 7)	29,699	698	5,785	182	3,108	294	525	78
3. Number of systems with purchase price $75,000-$1,000,000 (Table 7)	3,924	371	812	154	110	25	150	42
4. Aggregate purchase price of all systems in national stock (in $ millions) (Table 10)	$1,631	$60	$334	$42	$97	$5	$60	$8
5. Aggregate purchase price of state-of-the-art systems (in $ thousands) (Table 10)	$372	$27	$75	$5	$24	$3	$11	$4
B. Estimates of ratios								
1. Mean purchase price per system (in $ thousands) (Table 4)	$35	$1	$35	$3	$24	$1	$54	$6
2. Percent of systems 1-5 years of age (Table 16)	47%	1%	53%	4%	45%	4%	81%	7%
3. Percent of systems over 10 years of age (Table 16)	29%	1%	29%	3%	26%	3%	11%	4%
4. Mean number of users of general purpose equipment (Table 36)	16.5	3.8	16.6	5.4	12.2	0.8	65.4	39.9
5. Mean number of users of dedicated equipment (Table 26)	8.2	1.1	9.8	2.5	6.5	0.7	21.4	8.3
Survey of departments and research facilities	(n = 912)		(n = 220)		(n = 41)		(n = 26)	
C. Estimates of totals								
1. Number of departments and facilities in survey universe (Table 4)	2,902	-	661	41	147	26	91	28
2. Annual expenditures for research equipment (in $ millions) (Table 13)	$414	$23	$86	$10	$19	$4	$20	$7
D. Estimates of ratios								
1. Percent of departments reporting inability to conduct critical experiments due to lack of needed equipment (Table 1)	72%	2%	89%	3%	41%	11%	93%	5%
2. Mean annual expenditures per university for purchase of research equipment (in $ thousands) (Table 15)	$2,127	$121	$551	$62	$76	$16	$126	$44

BEST COPY AVAILABLE